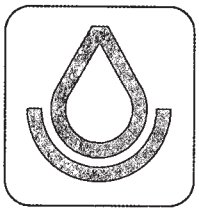
SOIL SURVEY OF

Green Lake County, Wisconsin



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Research Division of the
College of Agricultural and Life Sciences
University of Wisconsin

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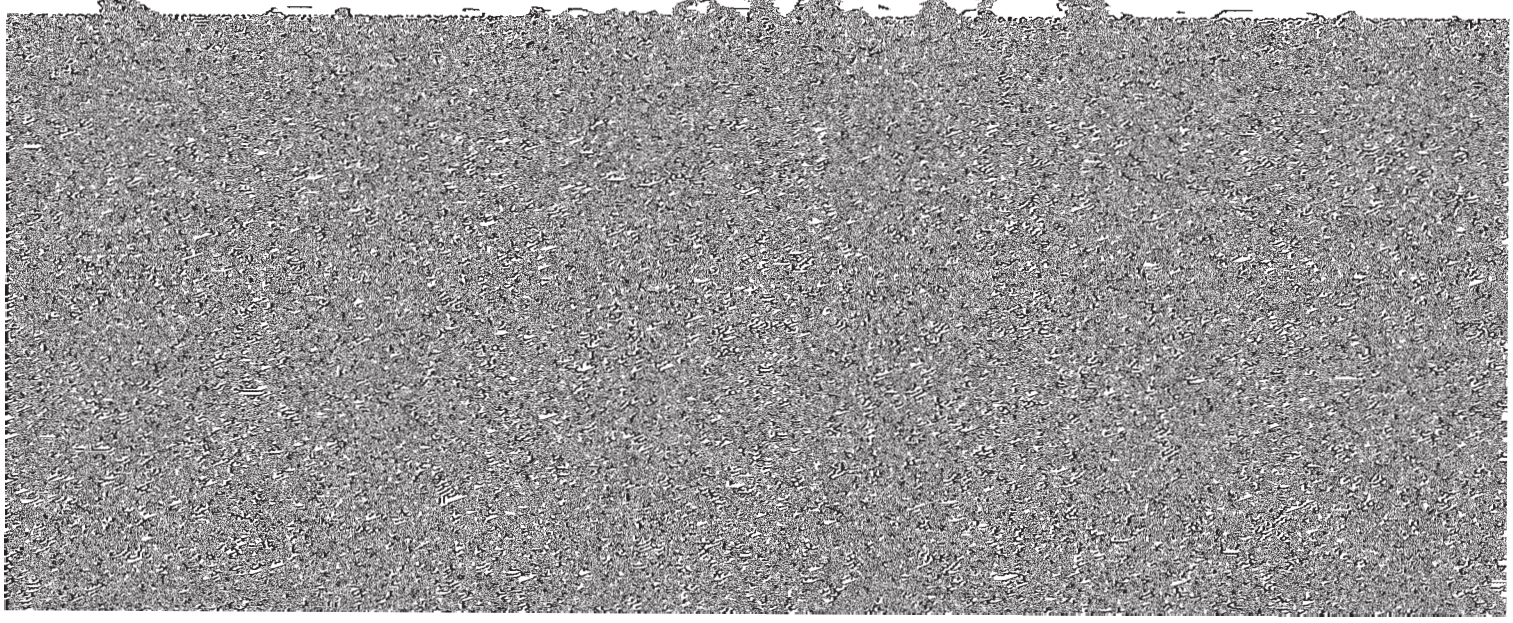

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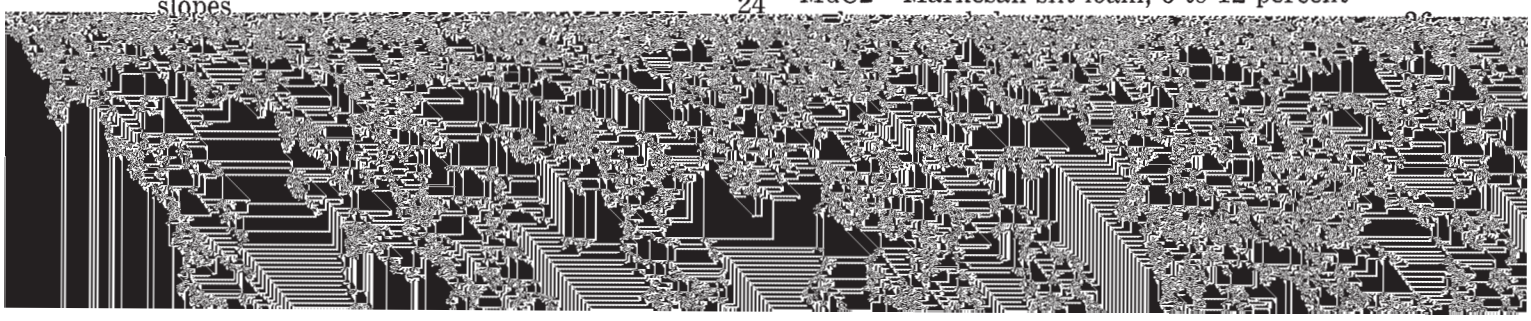

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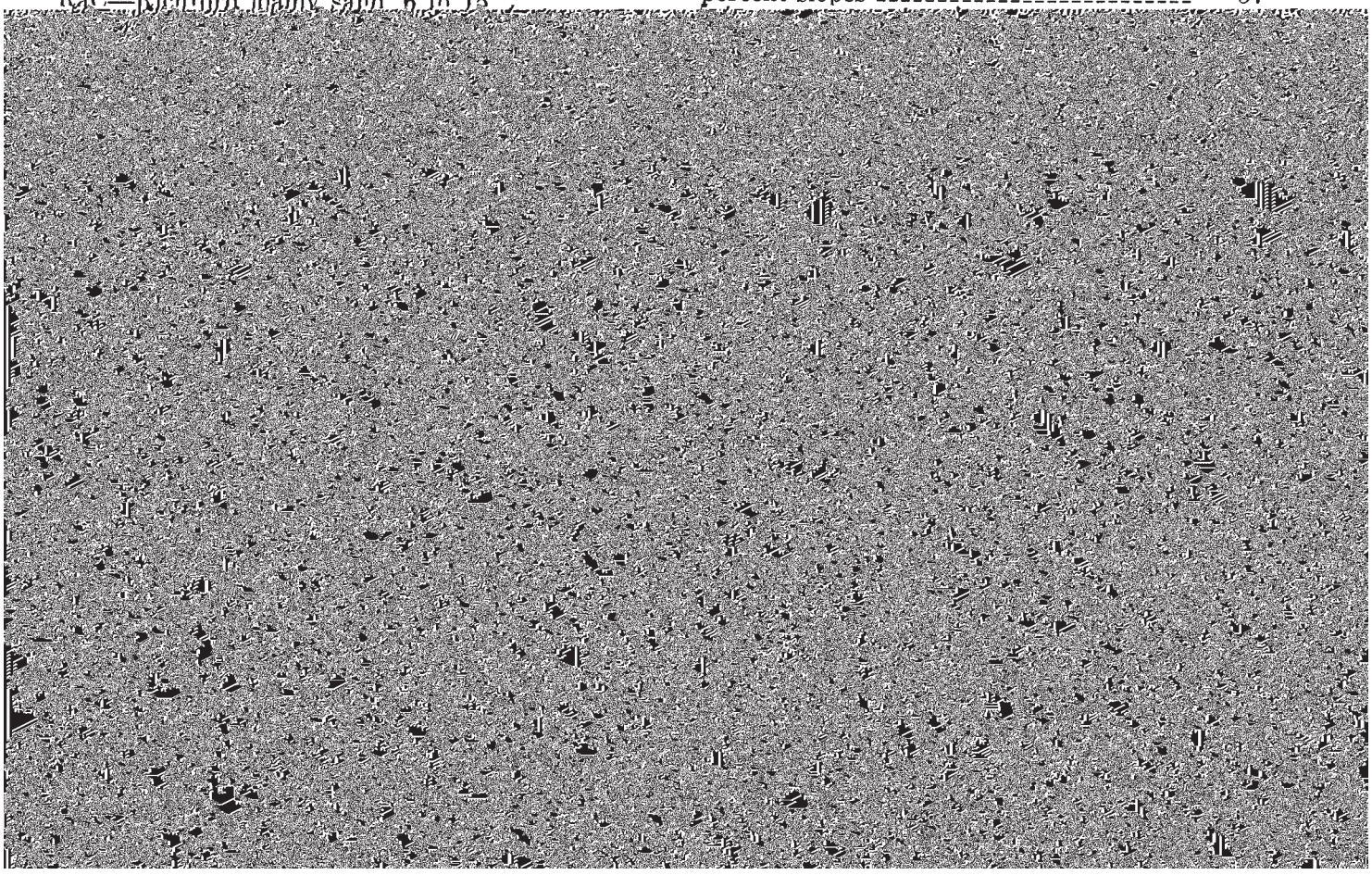

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SOIL SURVEY OF GREEN LAKE COUNTY, WISCONSIN

BY FRANK L. ANDERSON AND HOWARD F. GUNDLACH, SOIL CONSERVATION SERVICE

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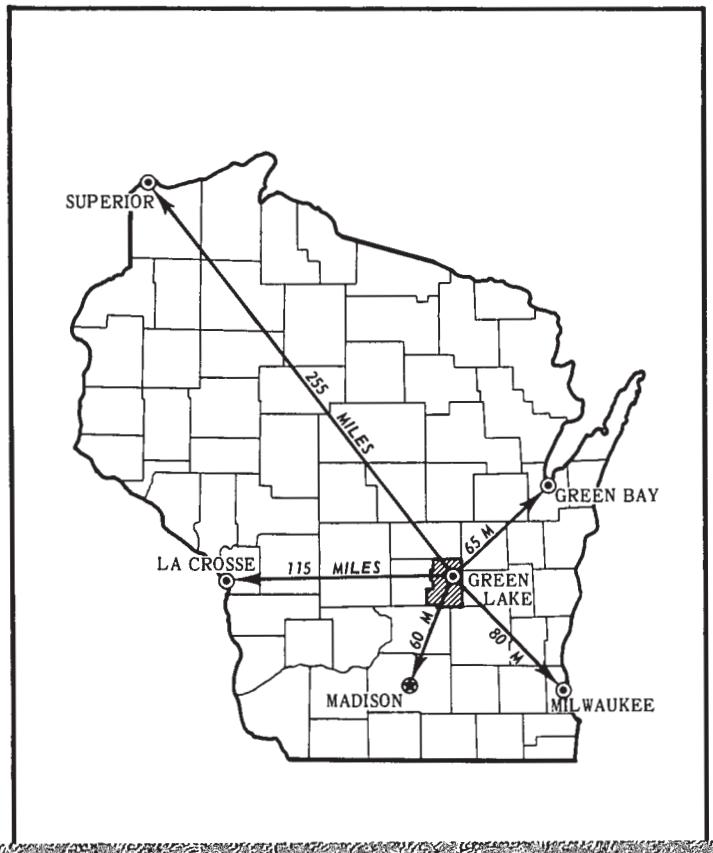
UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE RESEARCH DIVISION OF THE COLLEGE OF AGRICULTURAL AND LIFE SCIENCES, UNIVERSITY OF WISCONSIN

GREEN LAKE COUNTY is located slightly southeast of the center of Wisconsin (fig. 1). It extends about 24 miles from north to south and 18 miles from east to west at its widest points. The total land area is about 354 square miles, or 226,816 acres. The county seat is the city of Green Lake, which is in the east-central part of the county. Green Lake County is named for the deepest lake in Wisconsin.



In 1970, the population of the county was 16,878. Berlin, in the northeast corner of the county, is the largest city and has a population of 5,297.

Farming, manufacturing, and tourism are important in Green Lake County. In 1970, about 15 percent of the workers were employed in jobs related to agriculture, 7 percent in construction, 29 percent in manufacturing, 4 percent in transportation and utilities, and 45 percent in other services. In 1969, 74.7 percent of the county was in farms.

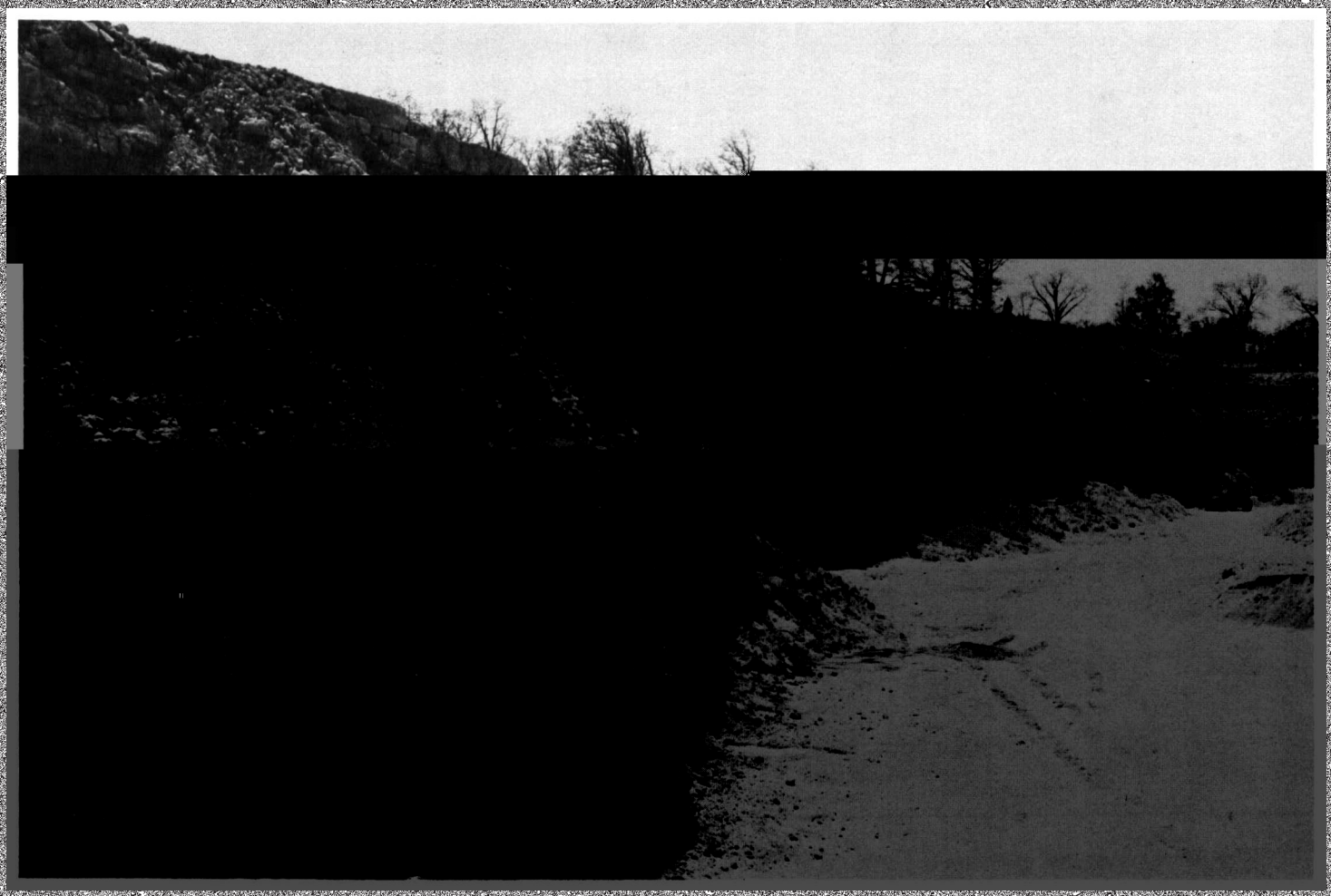
The number of farms is decreasing, and the average size of farms is increasing. An average farm income of $17,000 is ahead of the State average. Milk is the most important source of farm income. The county ranks among the highest quarter of Wisconsin counties in hog marketing and in the processing of sweet corn and green peas.

Originally the county was not extensively forested. Today about 12 percent of the land area is woodland. The woodlands are mostly small tracts scattered through the northern and western parts of the county. These tracts supply wood products needed on farms, and they provide some cash income from the sale of wood products.

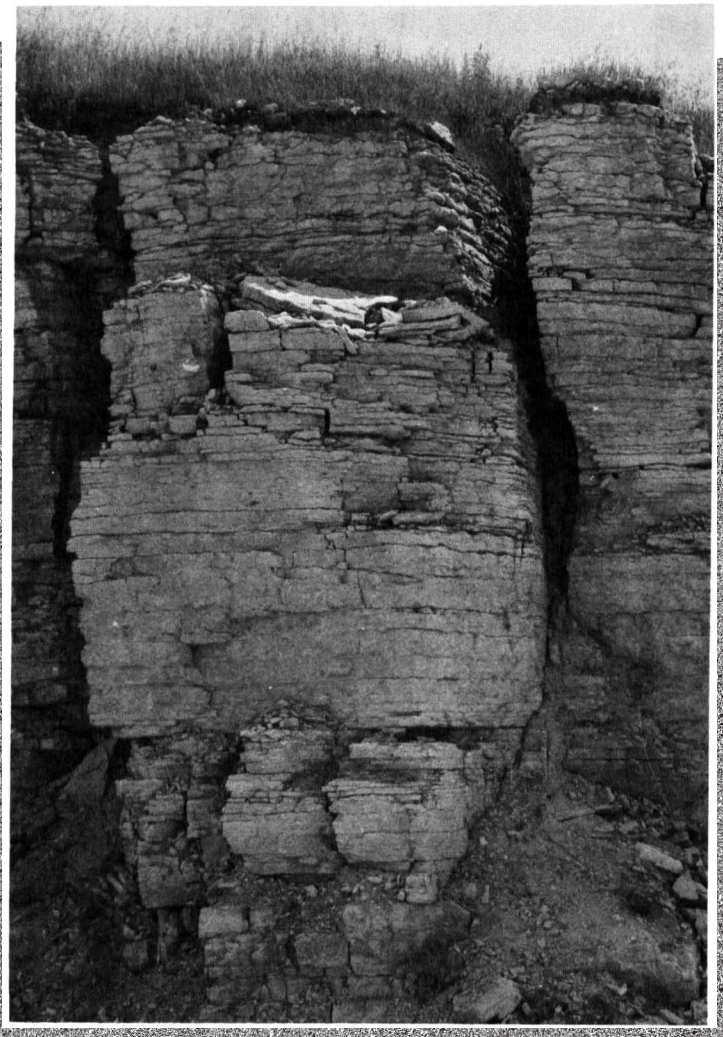
Green Lake County has made relatively greater gains in manufacturing than the rest of the State from 1963 to 1967—in number of persons employed, in payroll, and in value added by manufacturing. There are

have made the county a popular vacation ground for

Underlying this high plateau at a relatively shallow



droughty. If cultivated, the loamy soils that formed in



of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

An undifferentiated group is made up of two or more soils or land types that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Rock land and Ritchey soils, 6 to 45 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock outcrop is a land type in Green Lake County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and range, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The General Soil Map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for managing a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Green Lake County are described on the pages that follow.

1. *Plano-Mendota-St. Charles association*

Well drained and moderately well drained, nearly level to sloping soils that have a subsoil mainly of silt loam and silty clay loam underlain by calcareous, gravelly or very gravelly sandy loam glacial till

This association consists of a high plain or plateau of ground moraine that has broad ridgetops and gentle swales. It is on glaciated uplands where the soils formed in windblown silts and the underlying glacial till. The soils are mostly nearly level and gently sloping but are steeper along drainageways and escarpments.

This association makes up about 30 percent of the county. It is about 28 percent Plano soils, 11 percent Mendota soils, 7 percent St. Charles soils, and 54 percent minor soils.

The Plano soils are nearly level and gently sloping and well drained and moderately well drained. They are on broad, slightly convex plains. They have a surface layer of silt loam. Their subsoil is silt loam and silty clay loam in the upper part and heavy sandy loam in the lower part. The substratum is gravelly sandy loam glacial till that begins at a depth of about 58 inches.

The Mendota soils are nearly level to sloping and well drained. They are mostly on low knolls. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and very gravelly loam in the lower part. The substratum is very gravelly sandy loam glacial till that begins at a depth of about 33 inches.

The St. Charles soils are nearly level to sloping and well drained and moderately well drained. They are chiefly on broad ridgetops. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and heavy sandy loam in the lower part. The substratum is gravelly sandy loam glacial till that begins at a depth of about 54 inches.

Of minor extent in this association are the Knowles, LeRoy, Ritchey, Colwood, Joy, Kibbie, Ossian, and Palms soils. LeRoy soils are intermingled with the St. Charles soils where the high plain breaks into major drainageways. Knowles and Ritchey soils are along escarpments where the glacial till is thin over dolomite. Colwood, Joy, Kibbie, Ossian, and Palms soils are in swales and wet drainageways.

for all of the cultivated crops commonly grown in the county. Most of the acreage is used for cultivated crops such as corn, small grains, and legumes, and some is used for canning crops such as sweet corn and peas. A large acreage is also used for dairy farming. A few steeper areas and undrained wet areas are used for pasture or wildlife habitat. A few areas are in woodland.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, and fertility. The wet soils need to be drained if they are to be used for crops.

The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

2. *Kidder-Rotamer-Grellton association*

Well drained and moderately well drained, nearly level to steep soils that have a subsoil mainly of loam, clay loam, and sandy clay loam underlain by calcareous, gravelly sandy loam glacial till

This association consists of ground moraine made up of swales, rounded hills, and drumlins on glaciated uplands. The soils are mostly gently sloping and sloping. In some places, stones and boulders are common on the surface and in the soil.

This association makes up about 27 percent of the county. It is about 23 percent Kidder soils, 5 percent Rotamer soils, 5 percent Grellton soils, and 67 percent minor soils.

The Kidder soils are nearly level to steep and are areas throughout the association where deposits of windblown sand are thick.

The soils of this association are suited to all the cultivated crops grown in the county. Most of the acreage is used for cultivated crops such as corn, small grains, and legumes, and some is used for canning crops such as sweet corn and peas. Some steeper areas and undrained wet areas are used for pasture or wildlife habitat, and some areas are in woods. Much of the acreage is used for dairy farming and raising beef cattle.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, and fertility. The wet soils need to be drained if they are to be used for crops.

The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

3. *Lapeer-Mecan-Okee association*

Well drained and somewhat excessively drained, gently sloping to steep soils that have a subsoil of sandy loam underlain by calcareous, gravelly sandy loam or gravelly loamy sand glacial till

This association consists of ground moraine made up of swales, rounded hills, and drumlins on glaciated uplands (fig. 4). The soils are mostly gently sloping and sloping. In many places, stones and boulders are common on the surface and in the soil.

This association makes up about 7 percent of the county. It is about 18 percent Lapeer soils, 9 percent

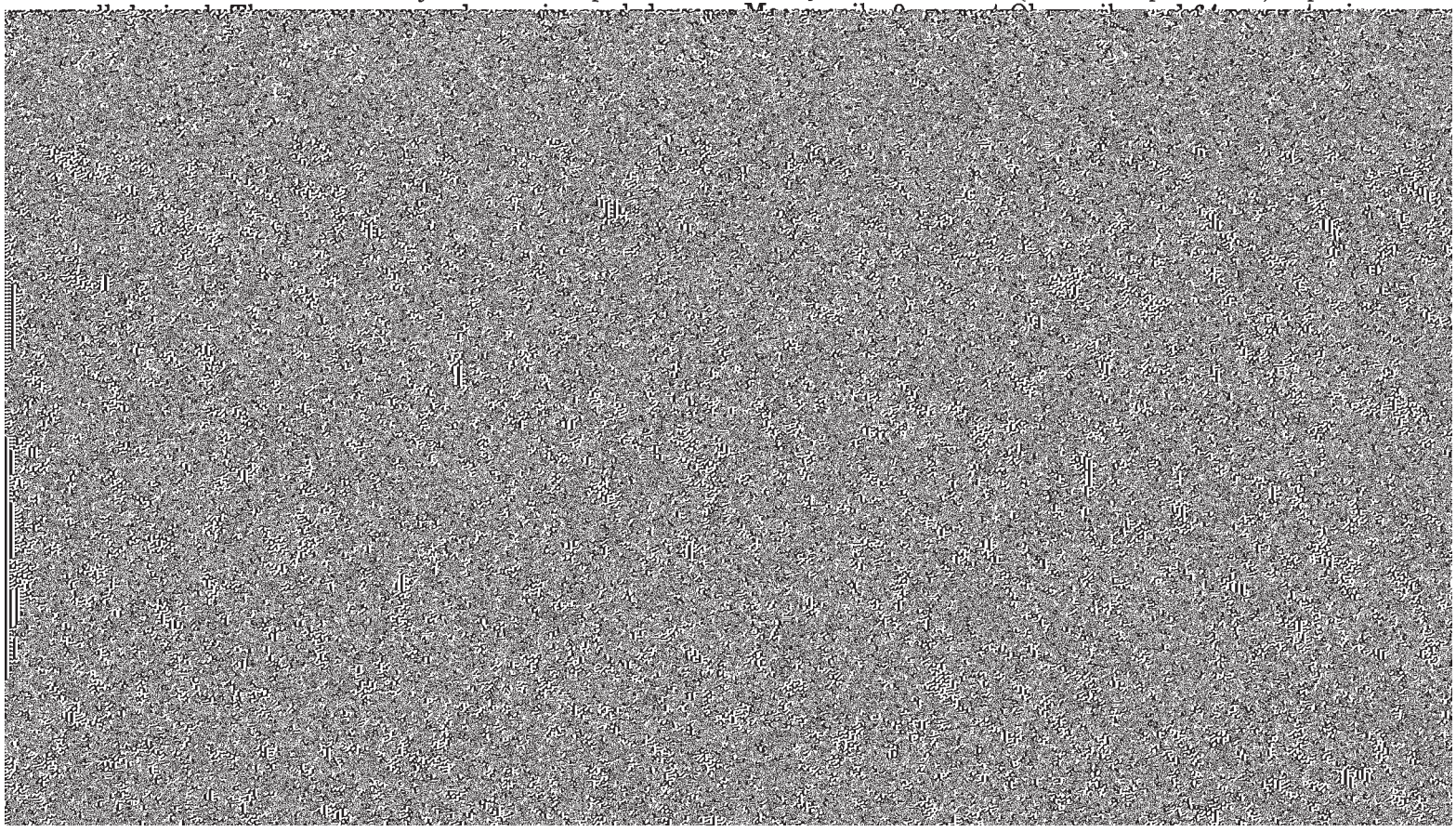


Figure 4.—**Typical area of the Lapeer-Mecan-Okee association.**

general farm crops grown in the county, but in an average year crop yields are limited by the available water capacity. Much of the acreage is used for cultivated crops such as corn, small grains, and legumes. Some areas are used for pasture and wildlife habitat, especially steeper areas and undrained wet areas. Small woodlots are common. Much of the acreage is used for dairy farming and raising beef cattle.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, available water, and fertility. Stones and boulders interfere with tillage in much of this association. The wet soils need to be drained if they are to be used for general

county. It is about 17 percent Oakville soils, 16 percent Brems soils, 14 percent Granby soils, and 53 percent minor soils.

The Oakville soils are nearly level to steep and are well drained. They are on outwash plains and terraces. They have a surface layer of fine sand. Their subsoil is fine sand. The substratum is fine sand in the upper part and medium sand in the lower part. It is at a depth of about 33 inches.

The Brems soils are nearly level and gently sloping and are moderately well drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand. Their subsoil is fine sand. The substratum is medium sand and is at a depth of about

managed, they are better suited to pasture, woodland, [illegible] glacial till knolls. Adrian, Colwood, Granby, Granby [illegible]

some is used for pasture. Small areas of woodland are common. The major soils of this association are too wet for cultivated crops, unless they are drained. Where drained, they are generally used to grow corn. Better drained areas of the minor soils in this association are used for corn, small grains, and legumes.

In cultivated areas, the main concern of management is maintaining adequate drainage, tilth, and fertility.

The major soils of this association have severe and very severe limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

7. Adrian-Houghton association

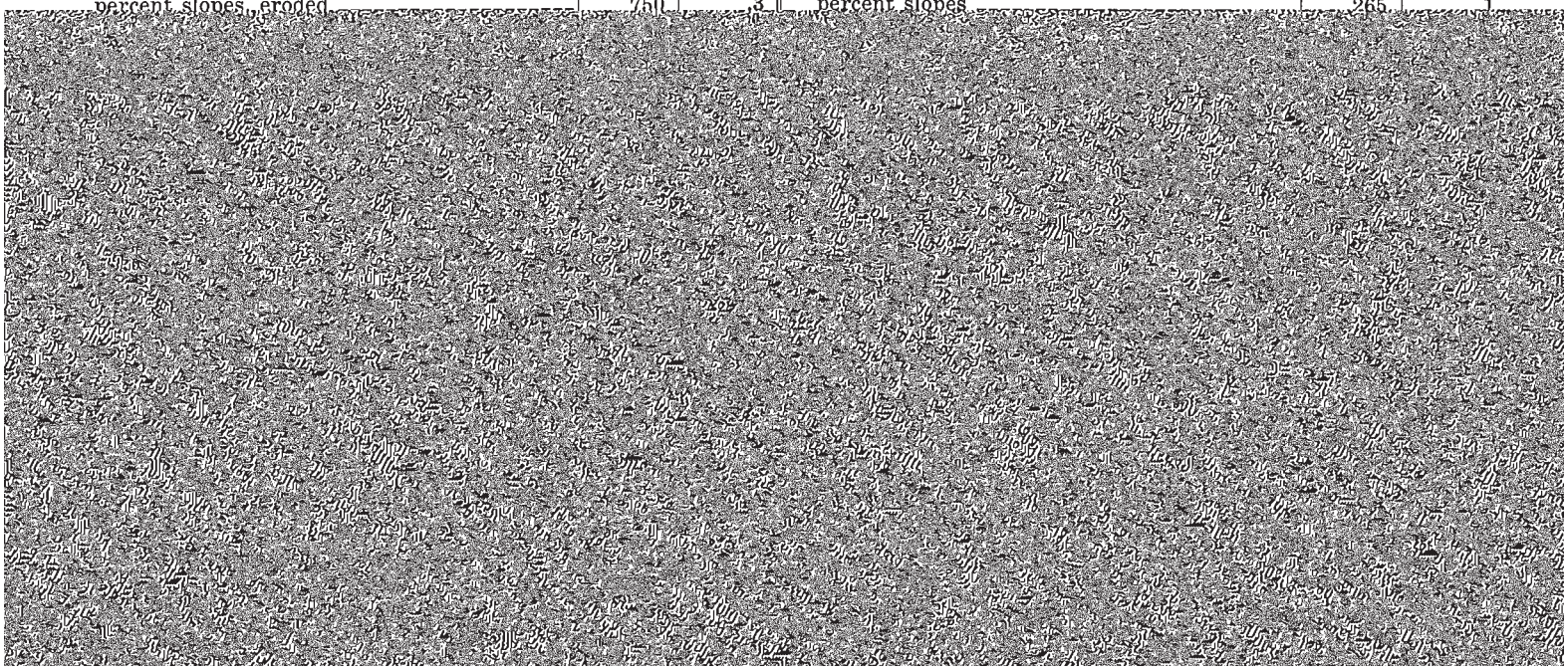
organic layer of highly decomposed muck about 36 inches thick. The substratum is outwash sand.

The Houghton soils are nearly level and very poorly drained. They are in drainageways, depressions, and old lake basins and on flood plains. The organic layer is highly decomposed muck more than 51 inches thick. The substratum is sandy, clayey, or loamy material or marl.

Some minor soils in this association are Brems, Kidder, and Oakville soils. Brems and Oakville soils are on sand knolls intermingled with Adrian and Houghton soils. Kidder soils are on isolated glacial till knolls in some parts of the association. Colwood, Granby, and Palms soils are intermingled with Adrian and Hough

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Adrian muck	9,300	4.1	Marcellon loam, 0 to 3 percent slopes	2,000	0.9
Alluvial land, wet	870	.4	Markesan silt loam, 2 to 6 percent slopes, eroded	530	.2
Barry loam	1,550	.7	Markesan silt loam, 6 to 12 percent slopes, eroded	1,350	.6
Boyer loamy fine sand, 1 to 6 percent slopes	2,800	1.2	Markesan silt loam, 12 to 20 percent slopes, eroded	240	.1
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	1,500	.7	Marsh	580	.3
Boyer loamy fine sand, 12 to 25 percent slopes	660	.3	Marshan silt loam	3,900	1.7
Brems loamy fine sand, 0 to 6 percent slopes	8,700	3.8	Mecan loamy fine sand, 2 to 6 percent slopes	1,900	.8
Briggsville silt loam, 0 to 2 percent slopes	320	.1	Mecan loamy fine sand, 6 to 12 percent slopes, eroded	560	.2
Briggsville silt loam, 2 to 6 percent slopes	780	.3	Mendota silt loam, 0 to 2 percent slopes	730	.3
Colwood silt loam	4,350	1.9	Mendota silt loam, 2 to 6 percent slopes	6,500	2.9
Dodge silt loam, 2 to 6 percent slopes	1,260	.6	Mendota silt loam, 6 to 12 percent slopes, eroded	500	.2
Dodge silt loam, 6 to 12 percent slopes, eroded	570	.3	Oakville fine sand, 1 to 6 percent slopes	5,600	2.5
Edwards muck	195	.1	Oakville fine sand, 6 to 12 percent slopes	1,500	.7
Friesland loam, 0 to 2 percent slopes	960	.4	Oakville fine sand, 12 to 35 percent slopes	375	.2
Friesland loam, 2 to 6 percent slopes	1,550	.7	Okee loamy fine sand, 1 to 6 percent slopes	5,900	2.6
Gotham loamy fine sand, 1 to 6 percent slopes	2,150	.9	Okee loamy fine sand, 6 to 15 percent slopes	1,300	.6
Gotham loamy fine sand, 6 to 12 percent slopes	550	.2	Oshtemo loamy fine sand, 1 to 6 percent slopes	1,550	.7
Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	285	.1	Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	350	.2
Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes	215	.1	Ossian silt loam	5,500	2.4
Granby loamy fine sand	11,000	4.8	Palms muck	3,100	1.4
Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes	4,000	1.8	Plano silt loam, 0 to 2 percent slopes	13,700	6.0
Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes	2,950	1.3	Plano silt loam, 2 to 6 percent slopes	7,800	3.4
Grellton fine sandy loam, 0 to 2 percent slopes	760	.3	Poy silty clay loam	5,400	2.4
Grellton fine sandy loam, 2 to 6 percent slopes	3,550	1.6	Poygan silty clay loam	3,850	1.7
Grellton fine sandy loam, 6 to 12 percent slopes, eroded	1,400	.6	Richford loamy sand, 1 to 6 percent slopes	940	.4
Grellton fine sandy loam, 12 to 20 percent slopes, eroded	455	.2	Richford loamy sand, 6 to 15 percent slopes	410	.2
Griswold silt loam, 0 to 2 percent slopes	255	.1	Ripon silt loam, 1 to 6 percent slopes	360	.2
Griswold silt loam, 2 to 6 percent slopes	2,300	1.0	Ritchey silt loam, 2 to 6 percent slopes, eroded	530	.2
Griswold silt loam, 6 to 12 percent slopes, eroded	1,100	.5	Ritchey silt loam, 6 to 12 percent slopes, eroded	870	.4
Houghton muck	12,500	5.5	Ritchey silt loam, 12 to 20 percent slopes, eroded	690	.3
Joy silt loam, 0 to 3 percent slopes	1,900	.8	Rock land and Ritchey soils, 6 to 45 percent slopes	1,400	.6
Kibbie loam, 0 to 3 percent slopes	2,050	.9	Rock outcrop	175	.1
Kidder fine sandy loam, 0 to 2 percent slopes	690	.3	Rodman gravelly sandy loam, 6 to 20 percent slopes	390	.2
Kidder fine sandy loam, 2 to 6 percent slopes	13,100	5.8	Rodman gravelly sandy loam, 20 to 35 percent slopes	265	.1
Kidder fine sandy loam, 6 to 12 percent slopes, eroded	3,700	1.6			
Kidder fine sandy loam, 12 to 20 percent slopes, eroded	750	.3			



have sandy, loamy, or clayey layers in the organic layer or have loamy or clayey layers in the underlying sand.

Runoff is very slow and is likely to pond during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage, but precautions must be taken to prevent loose sand from entering the tile lines. Cultivated areas of this soil are subject to soil blowing and burning. If the water table is lowered excessively in such areas, the organic matter decomposes very rapidly and subsidence becomes a problem.

Where this soil is drained, it is suitable for vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn. Some undrained areas are used for unimproved pasture. Capability unit IVw–7; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Alluvial Land, Wet

An—Alluvial land, wet. This mapping unit consists of nearly level, poorly drained, recent stream deposits on flood plains and along the edges of lakes. Areas are generally elongated and cover 5 to 80 acres. Unless these soils are drained, ground water is at or near the surface throughout the year.

This soil has a wide range of profile characteristics. The surface layer ranges from sand to silt loam, and in some areas it is organic. The substratum is stratified sandy and loamy deposits that have strata of organic soil in some places. The vegetation is mainly marsh

gravelly loamy sand to a depth of 60 inches and has light brownish-gray mottles.

The available water capacity is high, and permeability is moderate. Root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, pasture, and hay. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Barry loam, approximately 430 feet east and 950 feet north of the southwest corner of the SE¼ of sec. 23, T 16 N., R. 11 E., in an uncultivated wetland:

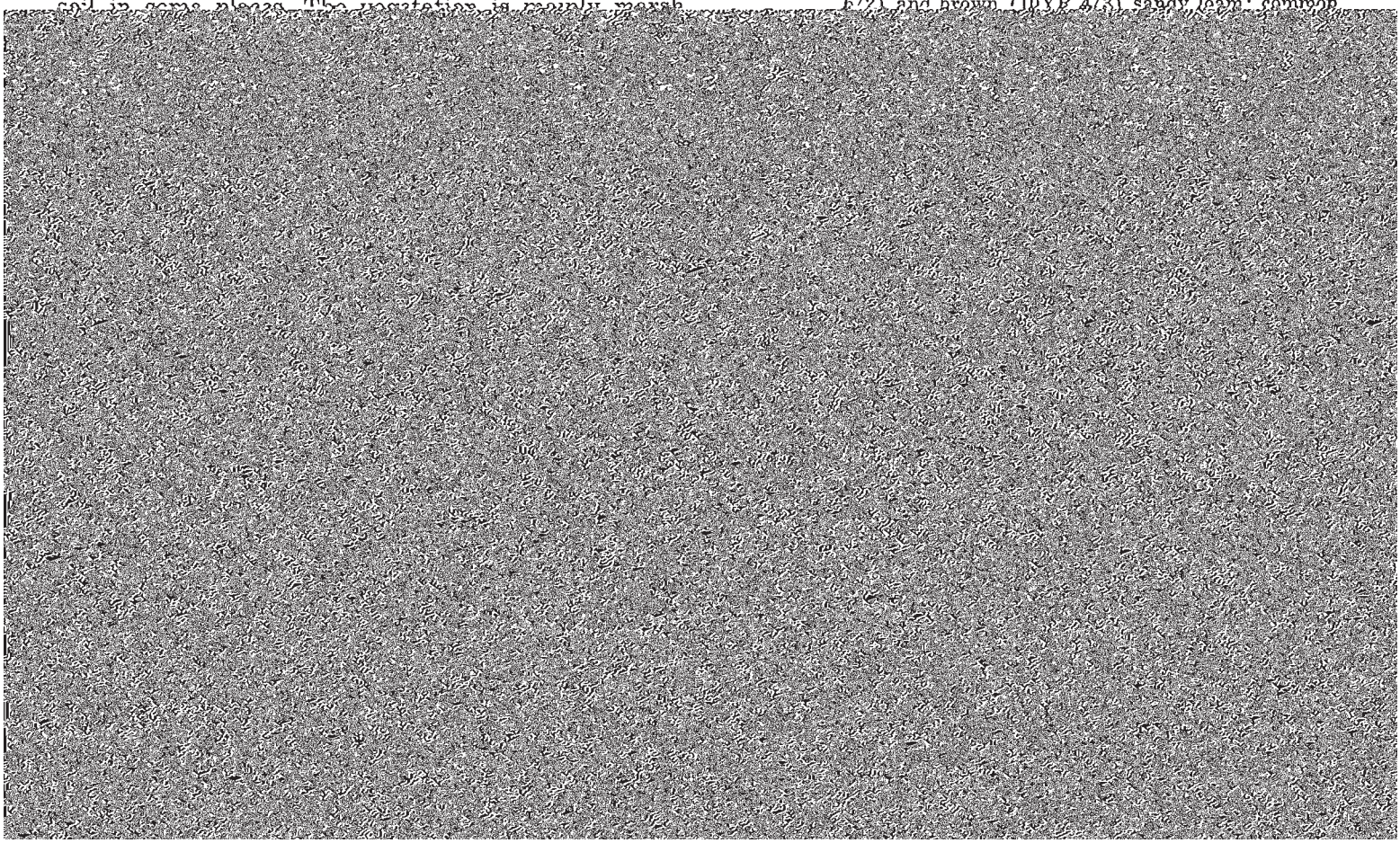
A11—0 to 8 inches, black (10YR 2/1) loam; few, fine, distinct, brown (10YR 4/3) mottles; moderate, medium, granular structure; very friable; few roots; common pores; slightly acid; abrupt, smooth boundary.

A12—8 to 10 inches, black (10YR 2/1) loam; common, fine, distinct, brown (10YR 4/3) mottles; weak, medium, granular structure; very friable; few roots; common pores; slightly acid; clear, smooth boundary.

A13—10 to 13 inches, very dark grayish-brown (10YR 3/2) heavy loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; very friable; few roots; common pores; neutral; clear, smooth boundary.

B2tg—13 to 24 inches, dark grayish-brown (10YR 4/2) clay loam; many, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; many thin clay films on faces of most peds; few roots; common pores; neutral; gradual, smooth boundary.

B3tg—24 to 31 inches, mixed, light brownish-gray (10YR 6/2) and brown (10YR 4/3) sandy loam; common



some places, this soil has cobbles and boulders on the surface and throughout the surface layer and subsoil.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during the wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

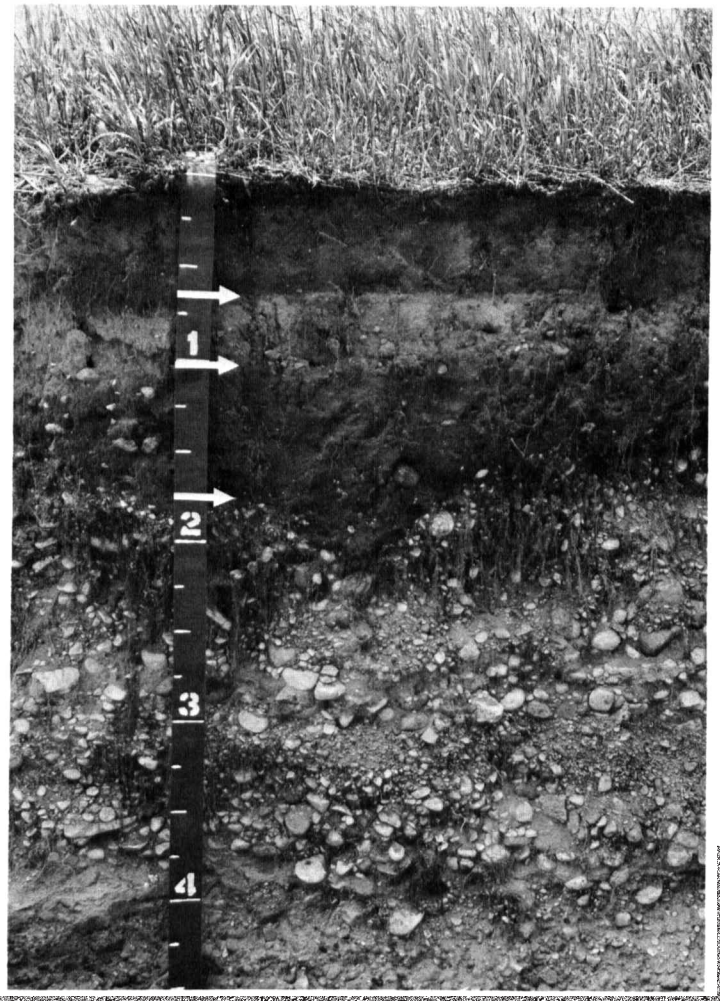
If drained, this soil is suitable for some vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn, small grains, pasture, and legumes. Some undrained areas are used for unimproved pasture. Capability unit IIw–1; woodland group 4w2; recreation group 7; wildlife group 7; tree and shrub group 3.

Boyer Series

The Boyer series consists of nearly level to steep, well-drained soils on outwash plains and terraces. These soils have a sandy and loamy subsoil underlain by stratified sand and gravel. The native vegetation is mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 8 inches thick (fig. 6). The subsoil is about 24 inches thick. It is brown, very friable loamy fine sand in the upper part; brown, firm, heavy sandy loam and light sandy clay loam in the middle part; and dark yellowish-brown, very friable loamy sand in the lower part. The substratum is brown, loose, stratified sand and gravel to a depth of 60 inches.

The available water capacity is low, and permeability



Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing. Crop yields during most seasons are limited because the soil has low available water capacity.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and to certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland and some has been planted to pine trees.

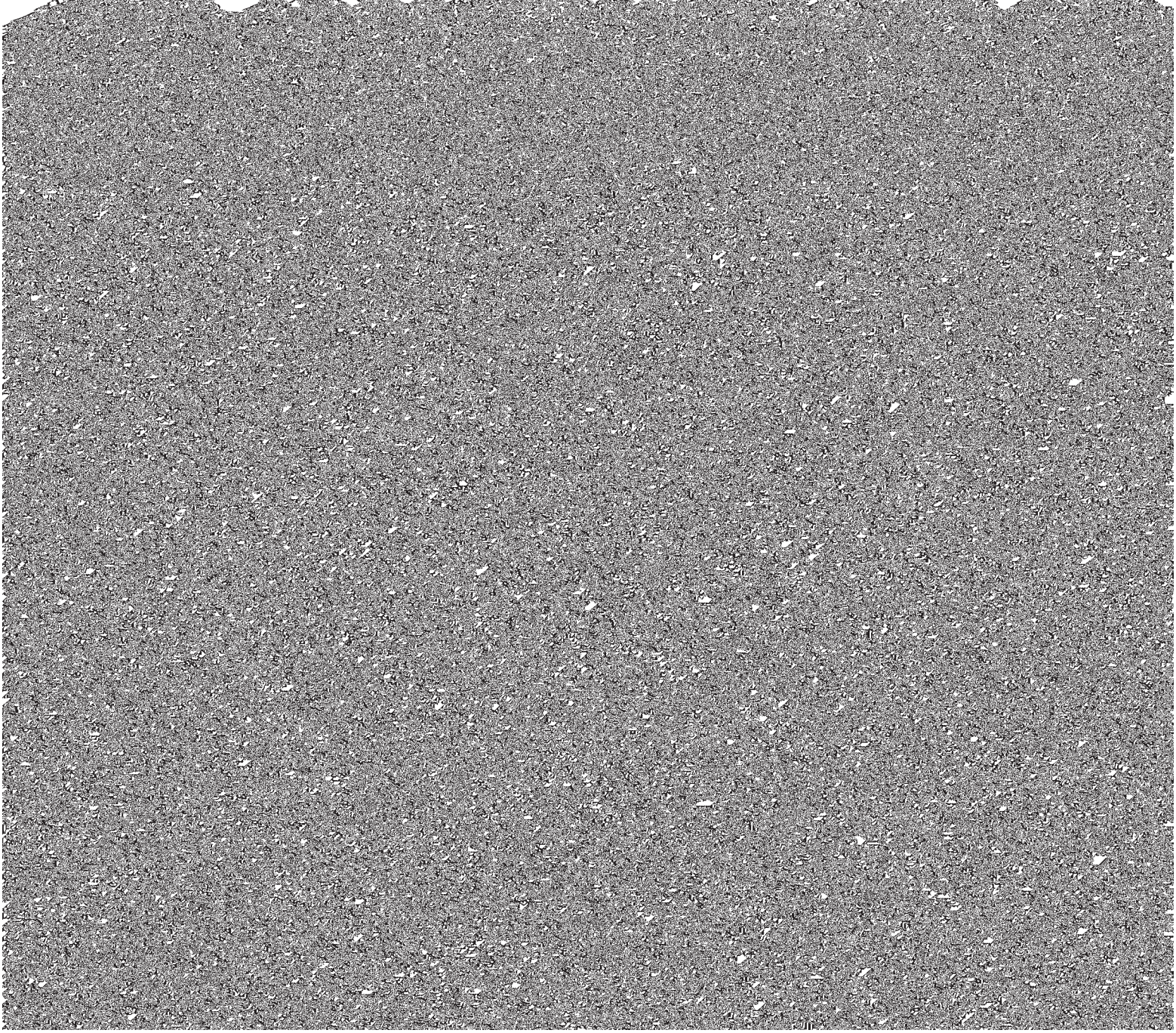
The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling soil blowing. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. Capability unit IIIe-4; woodland

have gravel throughout the surface layer and subsoil, or are underlain by gravelly sandy loam till.

Runoff is medium, and the hazard of erosion is severe. This soil is subject to soil blowing. The low available water capacity limits crop yields during most seasons.

This soil is not suited to row crops unless erosion is controlled. It is better suited to close-growing crops and woodland.

Most of the acreage is used for hay, pasture, or native woodland. Some areas have been planted to pine trees. Row crops are grown in some of the less sloping areas, but many areas that were cultivated are now in pasture or woodland. The main concerns of management are regularly supplying additions of organic



few roots; many pores; medium acid; clear, wavy boundary.

B22—18 to 27 inches, yellowish-brown (10YR 5/6) fine sand; few, fine, prominent, dark-red (2.5YR 3/6) and distinct, dark reddish brown (5YR 3/4) mottles and common, medium, faint, strong-brown (7.5YR 5/6) mottles; single grained; loose; few roots; medium acid; gradual, wavy boundary.

B23—27 to 32 inches, yellowish-brown (10YR 5/6) fine sand; common, medium, distinct, yellowish-red (5YR 4/8) mottles; single grained; loose; few roots; medium acid; clear, wavy boundary.

B3—32 to 38 inches, yellowish-brown (10YR 5/6) fine sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles and few, fine, distinct, yellowish-red (5YR 4/8) mottles; single grained; loose; slightly acid; clear, wavy boundary.

C—38 to 60 inches, pale-brown (10YR 6/3) medium sand; few, fine, prominent, yellowish-red (5YR 4/8) mottles; single grained; loose; slightly acid.

The solum is 24 to 55 inches thick. The A1 or Ap horizon is very dark brown, very dark gray, very dark grayish brown, or dark brown and is 3 to 9 inches thick. The B2 horizon is loamy fine sand or fine sand 10 to 26 inches thick. The C horizon is sand or fine sand.

Brems soils are near Granby and Oakville soils. Brems soils are moderately well drained, Granby soils are poorly drained, and Oakville soils are well drained.

BrB—Brems loamy fine sand, 0 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces and in old glacial lake basins. Most areas are elongated to irregular in shape and cover 3 to 50 acres.

Included with this soil in mapping are small areas of Granby soils. Some small areas have a fine sand surface layer. Some small areas have thin loamy or clayey strata in the subsoil and the substratum. Also included are areas where the substratum is stratified silt and fine sand, or is sand underlain by loamy or clayey deposits below a depth of 50 inches, or is gravelly.

Runoff is slow. The hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Early spring plantings, before the soil has a chance to dry, are best for this soil.

This soil is suited to irrigation. With fertilization, supplemental irrigation, and protection from soil blowing, it can be used for farm crops and certain vegetable crops. Most of the acreage is used for pasture, woodland, and wildlife habitat, but some areas are used for crops. Some areas have been planted to pine trees.

The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling soil blowing. Capability unit IVs–3; woodland 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

Briggsville Series

The Briggsville series consists of nearly level and gently sloping, well drained and moderately well drained soils on old glacial lake basins. These soils have a clayey subsoil underlain by stratified lacustrine silty clay loam, silty clay, and clay. The native vegetation was mixed hardwood forest. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsurface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is about 23 inches thick. It is reddish-brown, firm silty clay loam in the upper part and reddish-brown, firm silty clay in the lower part. The substratum is reddish-brown, firm stratified silty clay loam, silty clay, and clay to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderately slow. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Briggsville silt loam, 0 to 2 percent slopes, approximately 585 feet east and 925 feet south of the northwest corner of the NE¼ of sec. 2, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish-gray (10YR 6/2) when dry; weak, fine and medium, granular structure; very friable; common roots; common pores; neutral; abrupt, smooth boundary.

A2—8 to 11 inches, light brownish-gray (10YR 6/2) silt loam; weak, medium, platy structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; neutral; abrupt, smooth boundary.

B1—11 to 13 inches, reddish-brown (5YR 4/4) silty clay loam; weak, medium, subangular blocky structure; firm; few roots; common pores; bleached silt particles on faces of most peds and thin patchy clay films on faces of some peds; medium acid; clear, smooth boundary.

B22t—13 to 30 inches, reddish-brown (5YR 4/3) silty clay; moderate, fine and medium, angular blocky structure; firm; few roots; common pores; bleached silt particles on vertical faces of peds and thin continuous clay films on faces of peds; medium acid; gradual, smooth boundary.

B23t—30 to 34 inches, reddish-brown (5YR 4/3) silty clay; weak, medium, prismatic structure parting to moderate, fine and medium, angular blocky; firm; few roots; common pores; thin continuous clay films on faces of peds; strongly acid; gradual, smooth boundary.

C—34 to 60 inches, reddish-brown (5YR 5/3) stratified silty clay loam, silty clay, and clay; weak, thick, platy structure; firm; few roots; few pores; bands of reddish-brown (5YR 5/3) silt loam as much as 2 inches thick in the lower part of this horizon; slight effervescence; moderately alkaline.

Thickness of the solum and depth to carbonates are 30 to 40 inches. The Ap horizon is very dark grayish brown, dark brown, or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is silty clay loam, silty clay, or clay and is 20 to 32 inches thick. The C horizon is silty clay loam or silty clay stratified with silt loam or clay or both. In some areas mottling occurs in the lower part of the B horizon and in the C horizon.

Briggsville soils are near Manawa, Sisson, and Tustin soils. Briggsville soils are well drained and moderately well drained, and Manawa soils are somewhat poorly drained. Briggsville soils formed in clayey lacustrine deposits, and Sisson soils formed in loamy deposits that overlie silt loam, and very fine sand lacustrine deposits. Briggsville soils lack the 20- to 40-inch thick sandy mantle of Tustin soils.

BsA—Briggsville silt loam, 0 to 2 percent slopes. This soil is nearly level, and it occupies the low terraces in the old glacial lake basins. The areas are irregular in shape and cover 3 to 60 acres. This

soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Manawa soils, Granby clayey subsoil variant, Tustin soils, and gently sloping Briggsville silt loam. In some areas the surface layer is sandy loam or loamy sand or texture is sandy loam, loam, or clay loam to a depth of 30 inches or the soil is underlain by gravelly sandy loam till.

Runoff is slow. Because the subsoil is clayey, rainwater does not readily enter this soil and, as a result, the surface layer becomes saturated. This soil dries slowly in spring and is likely to be ponded after heavy rains. Because of the small total acreage, it is placed in the capability grouping with soils that formed in similar materials but are subject to erosion.

This soil is suitable for most of the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic matter and good tilth. Capability unit IIe–6; woodland group 2c1; recreation group 3; wildlife group 2; tree and shrub group 1.

BsB—Briggsville silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on low terraces in old glacial lake basins. Areas are irregular in shape and cover 3 to 50 acres.

This soil has a surface layer that is 2 to 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Manawa, Granby clayey subsoil variant, and Tustin soils. Also included are small, nearly level areas and eroded areas of Briggsville silt loam. In some places the surface layer is sandy loam or loamy sand or the texture is sandy loam, loam, or clay loam to a depth of 30 inches. Also included are small areas that are underlain by gravelly sandy loam till.

Runoff is medium. The hazard of erosion is moderate. Because the subsoil is clayey, rainwater does not readily enter this soil and the silt loam surface layer is more easily eroded. Where erosion has removed the surface layer and exposed the subsoil, tilth is poor. This soil dries slowly in spring and has water standing in low spots after heavy rains.

This soil is suitable for most of the farm crops com-

about 18 inches thick and has yellowish-brown and brownish-yellow mottles. It is light olive-gray, friable loam in the upper part and light-gray, friable silt loam in the lower part. The substratum is light-gray, friable silt loam to a depth of 60 inches and contains coarse silt, fine sand, and very fine sand strata. The substratum has brownish-yellow, strong-brown, brown, and pinkish-gray mottles.

The available water capacity is very high, and permeability is moderate. The depth of root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wetland wildlife habitat, and some areas are used for unimproved pasture.

Representative profile of Colwood silt loam, approximately 920 feet north and 1,180 feet east of the southwest corner of NW¼ of sec. 15, T. 16 N., R. 13 E., in a once-cultivated field:

Ap—0 to 10 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; few roots; common pores; mildly alkaline; abrupt, smooth boundary.

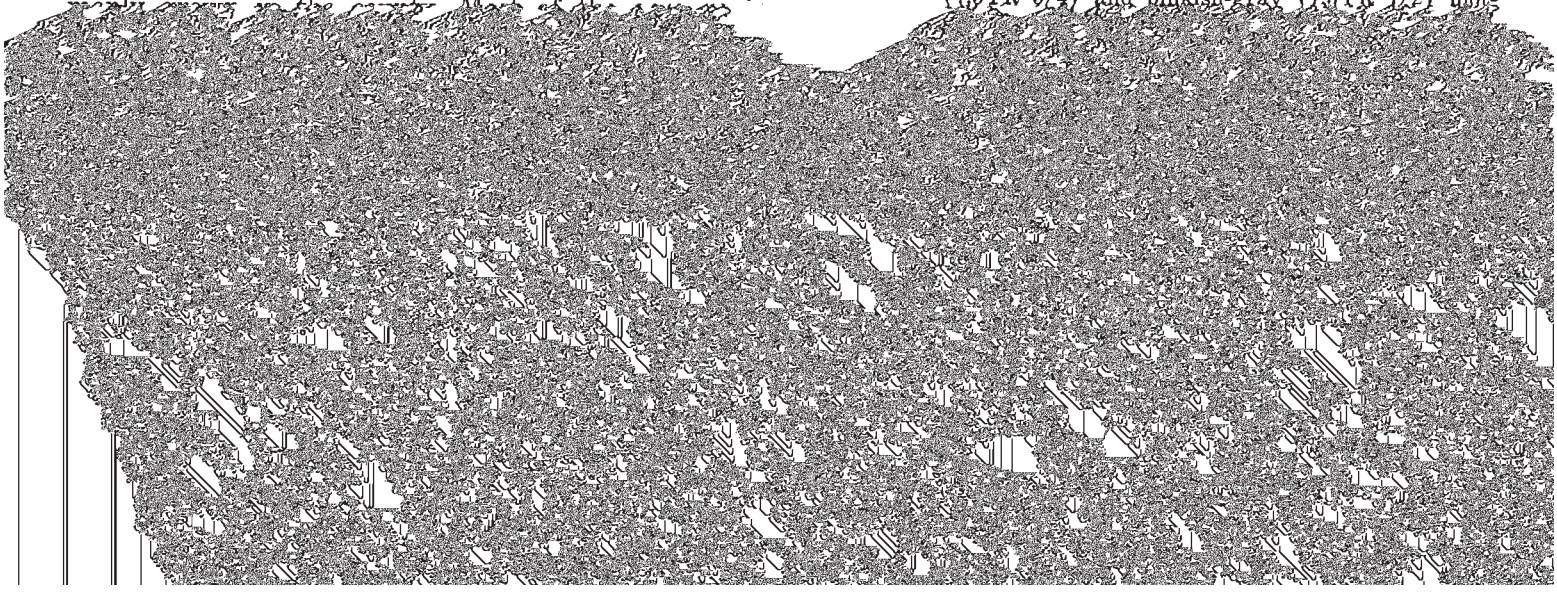
B21g—10 to 15 inches, light olive-gray (5Y 6/2) loam; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; few roots; few pores; mildly alkaline; clear, smooth boundary.

B22g—15 to 22 inches, light olive-gray (5Y 6/2) heavy loam; many, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; few roots; few pores; mildly alkaline; gradual, smooth boundary.

IIB23g—22 to 28 inches, light-gray (5Y 6/1) silt loam that has thin strata of fine sand; moderate, medium, prominent, brownish-yellow (10YR 6/6) mottles; weak, fine, subangular blocky structure; friable; slight effervescence; mildly alkaline; clear, smooth boundary.

IIC1g—28 to 38 inches, light-gray (5Y 7/1) silt loam that has thin strata of coarse silt and fine sand; common, medium, prominent, brownish-yellow (10YR 6/6) and strong-brown (7.5YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline; gradual, smooth boundary.

IIC2g—38 to 60 inches, light-gray (5Y 7/1) silt loam that has thin strata of coarse silt, fine sand, and very fine sand; common, medium, prominent, brown (7.5YR 5/4) and pinkish-gray (7.5YR 7/2) mot-



Included with this soil in mapping are small areas of Kibbie, Marshan, Palms, and Poy soils and small areas of Colwood silt loam that has slopes of as much as 4 percent. In some areas the surface layer is silty clay loam or sandy loam, or it is muck as much as 16 inches thick, or the substratum is stratified silt and clay.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Precautions must be taken to prevent loose sand from entering the tile lines.

Drained areas of this soil are suitable for some vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn, small grains, and pasture. Some undrained areas are used for unimproved pasture. Capability unit IIw–1; woodland group 1w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Dodge Series

The Dodge series consists of gently sloping and sloping, well-drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. It is yellowish-brown, friable and firm silt loam and silty clay loam in the upper part and dark yellowish-brown, firm clay loam in the lower part. The substratum is light yellowish-brown, friable gravelly sandy loam to a depth of 60 inches.

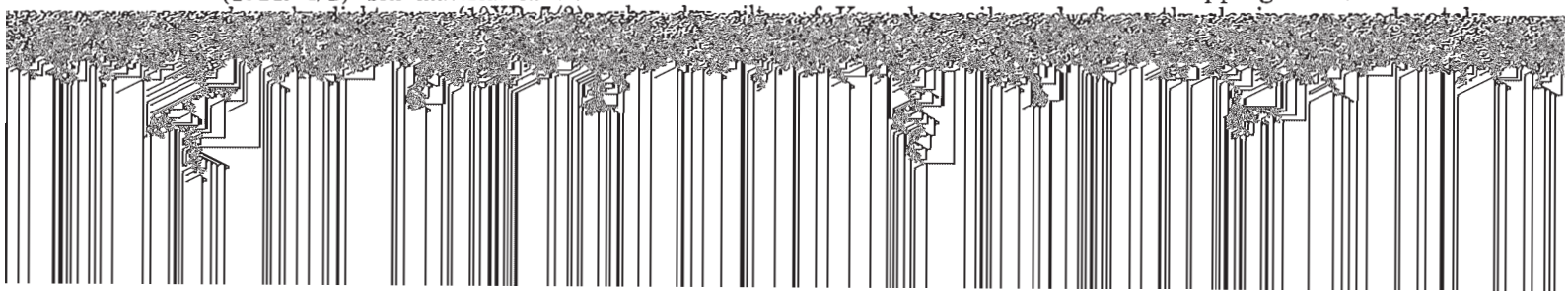
The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage of these soils is used for corn, small grains, legumes, and other crops commonly grown in the county. Some areas of sloping soils are used as woodland or for wildlife habitat.

Representative profile of Dodge silt loam, 2 to 6 percent slopes, approximately 660 feet north and 400 feet east of the southwest corner of the SE¼ of sec. 6, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; few roots; few pores; pockets of yellowish-brown (10YR 5/4) subsoil mixed in by plowing; neutral; abrupt, smooth boundary.

B1t—8 to 13 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak, fine, subangular blocky structure; friable; few roots; few pores; dark grayish-brown (10YR 4/2) soil material in old root and worm



silt loam; moderate, medium and fine, subangular blocky structure; firm; few roots; few pores; many, thin, dark yellowish-brown (10YR 4/4) clay films on faces of peds and in old root channels; medium acid; clear, wavy boundary.

IIB23t—27 to 33 inches, dark yellowish-brown (10YR 4/4) clay loam; weak, medium and fine, subangular blocky structure; firm; few roots; common pores; many thin clay films on faces of peds; thin, discontinuous, very dark grayish-brown (10YR 3/2) clay films on faces of some peds and in old root channels; about 3 percent, by volume, gravel of mixed origin; medium acid; clear, smooth boundary.

IIC—33 to 60 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; friable; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 36 percent.

The solum is 28 to 40 inches thick and overlies calcareous, gravelly sandy loam glacial till. The mantle of silty eolian sediment is 26 to 36 inches thick. The Ap horizon is dark grayish brown or brown and is 6 to 9 inches thick. The B1 horizon is heavy silt loam or light silty clay loam 3 to 8 inches thick. The B2t horizon is silty clay loam or heavy silt loam 10 to 25 inches thick. The IIB2t horizon is clay loam or heavy loam 3 to 7 inches thick. Coarse fragments, including cobbles and boulders, in the IIC horizon range from 5 percent to about 25 percent, by volume.

Dodge soils are near Knowles and St. Charles soils. Dodge soils are underlain by gravelly sandy loam till and Knowles soils by dolomite. Dodge soils have a thinner mantle of silty eolian sediment and a thinner solum than St. Charles soils.

DdB—Dodge silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 5 to 80 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of LeRoy soils, and small areas of nearly level or sloping and eroded and severely eroded Dodge silt loam. In some places the mantle of silty eolian sediment is 20 to 26 inches thick, or the subsoil is mottled, or dolomite is at a depth of 40 to 60 inches.

Runoff is medium. The hazard of erosion is slight to moderate.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

DdC2—Dodge silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes of broad ridges on the till plains. Areas are elongated and cover 5 to 40 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas

This soil is suitable for all the farm and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

Edwards Series

The Edwards series consists of nearly level, very poorly drained soils in depressions and old glacial lake basins. These soils are organic and are underlain by marl. The native vegetation was marsh vegetation such as sedges, reeds, and grasses; shrubs such as willow, alder, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black, nonsticky muck about 30 inches thick. The substratum is white, very friable marl to a depth of 60 inches.

The available water capacity is very high. Permeability is rapid in the organic layer and slow in the substratum. The depth of root penetration is limited by the water table or, in drained areas, by the underlying marl. Natural fertility is low.

Where these soils are drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Edwards muck, 920 feet north and 550 feet west of the center of sec. 18, T. 14 N., R. 13 E., in a cultivated field:

Oap—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; about 2 percent fiber, a trace rubbed; weak, fine and very fine, crumb structure; nonsticky; mainly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa2—8 to 23 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, a trace rubbed; weak, medium and coarse, crumb structure; nonsticky; mainly herbaceous fibers; neutral; clear, smooth boundary.

Oa3—23 to 30 inches, black (N 2/0, broken face and rubbed) sapric material; about 2 percent fiber, a trace rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; about 20 percent, by

Houghton, Palms, and Ossian soils. Also included are some areas where the organic layer is less than 16 inches thick and small areas that have as much as 16 inches of loamy overwash.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. The tile should be placed in the organic material because the marl is slowly permeable. Cultivated areas are subject to soil blowing and burning. Where the water table is lowered excessively in cultivated areas, the organic matter decomposes very rapidly and subsidence becomes a problem.

Where this soil is drained, it is suitable for certain vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn and mint. Capability unit IVw–7; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

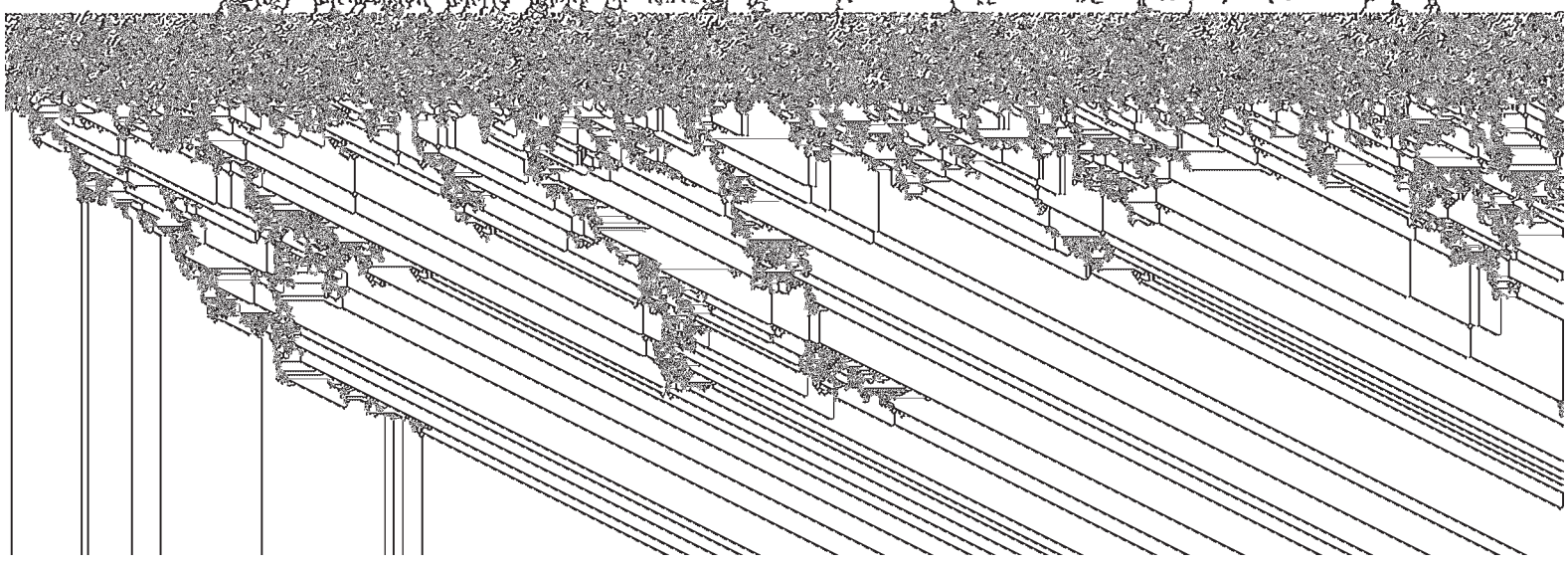
Friesland Series

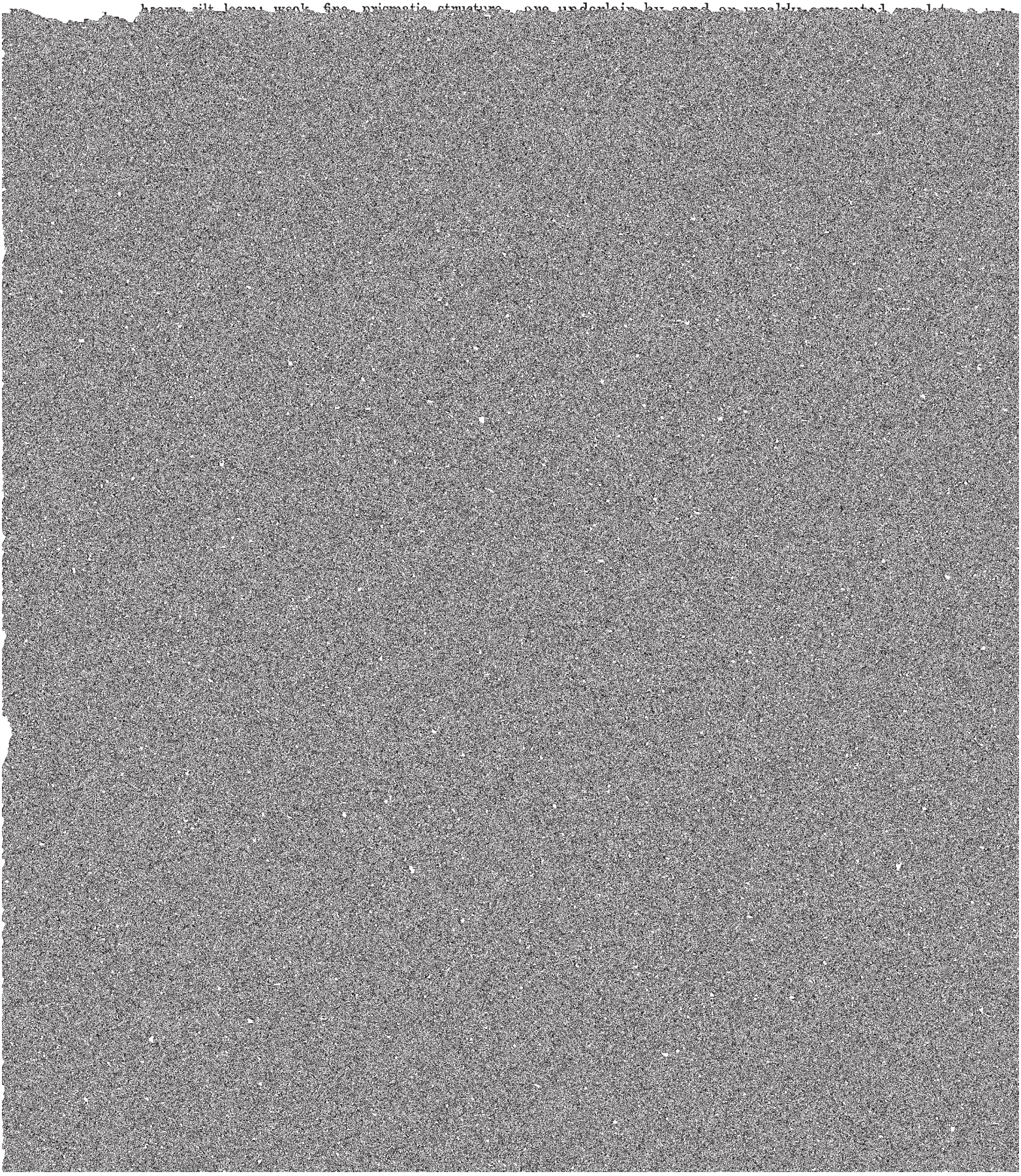
The Friesland series consists of nearly level and gently sloping, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by silt loam eolian deposits or gravelly sandy loam glacial till. The native vegetation was prairie grasses. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is about 13 inches thick. It is very dark gray loam in the upper part and very dark grayish-brown loam in the lower part. The subsoil is about 53 inches thick. It is dark-brown, friable loam in the upper part; dark yellowish-brown, friable fine sandy loam in the middle part; and dark yellowish-brown, and yellowish-brown, friable silt loam in the lower part. The substratum is brown, friable silt loam to a depth of 74 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. Canning crops such as peas such as peas and sweet corn are also grown.





below a depth of 50 to 60 inches or that are underlain by sandstone bedrock below a depth of 30 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Early spring plantings, before the soil has a

depth to sandstone bedrock is more than 39 inches or less than 20 inches. In some places the surface layer is fine sand.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during

sand. Natural fertility is low. The organic-matter content of the surface layer is moderately low.

Where drained, most of the acreage is used for corn, small grains, and hay. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Granby loamy fine sand, approximately 60 feet east and 660 feet north of the center of sec. 13, T. 15 N., R. 11 E., in a formerly cultivated field:

Ap—0 to 8 inches, black (10YR 2/1) loamy fine sand; weak, fine, granular structure, single grained where disturbed; very friable; few roots; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, very dark gray (10YR 3/1) loamy fine sand; common, medium, distinct, dark grayish-brown (2.5Y 4/2) mottles; weak, coarse, subangular blocky structure, single grained where disturbed; very friable; few roots; slightly acid; abrupt, smooth boundary.

B2g—11 to 14 inches, mixed dark grayish-brown (2.5Y 4/2) and light brownish-gray (2.5Y 6/2) fine sand; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; some very dark gray (10YR 3/1) soil material in old root channels; slightly acid; clear, smooth boundary.

B31—14 to 21 inches, yellowish-brown (10YR 5/4) fine sand; common, fine, distinct, brownish-yellow (10YR 6/6) and light brownish-gray (2.5Y 6/2) mottles and few, fine faint, brown (7.5YR 4/4) mottles; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; slightly acid; gradual, wavy boundary.

B32—21 to 35 inches, yellowish-brown (10YR 5/6) fine sand; few, medium, prominent, dark-red (2.5YR 3/6) mottles; very weak, coarse, subangular blocky

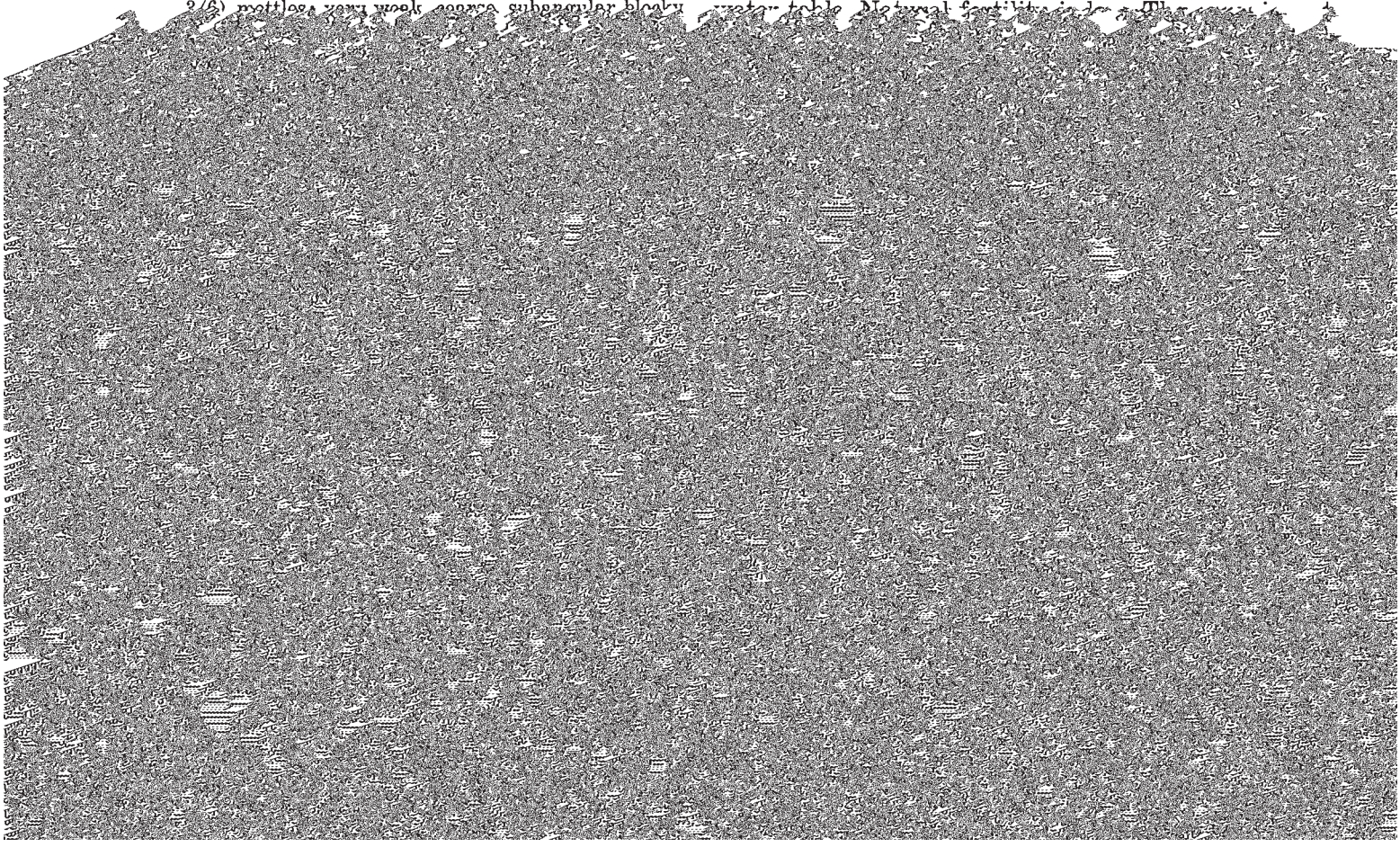
Where this soil is properly managed, it is suitable for certain vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Some undrained areas are used for unimproved pasture. Where drained, this soil is used for corn, small grains, and hay. Capability unit IVw–5; woodland group 3w1; recreation group 7; wildlife group 7; tree and shrub group 3.

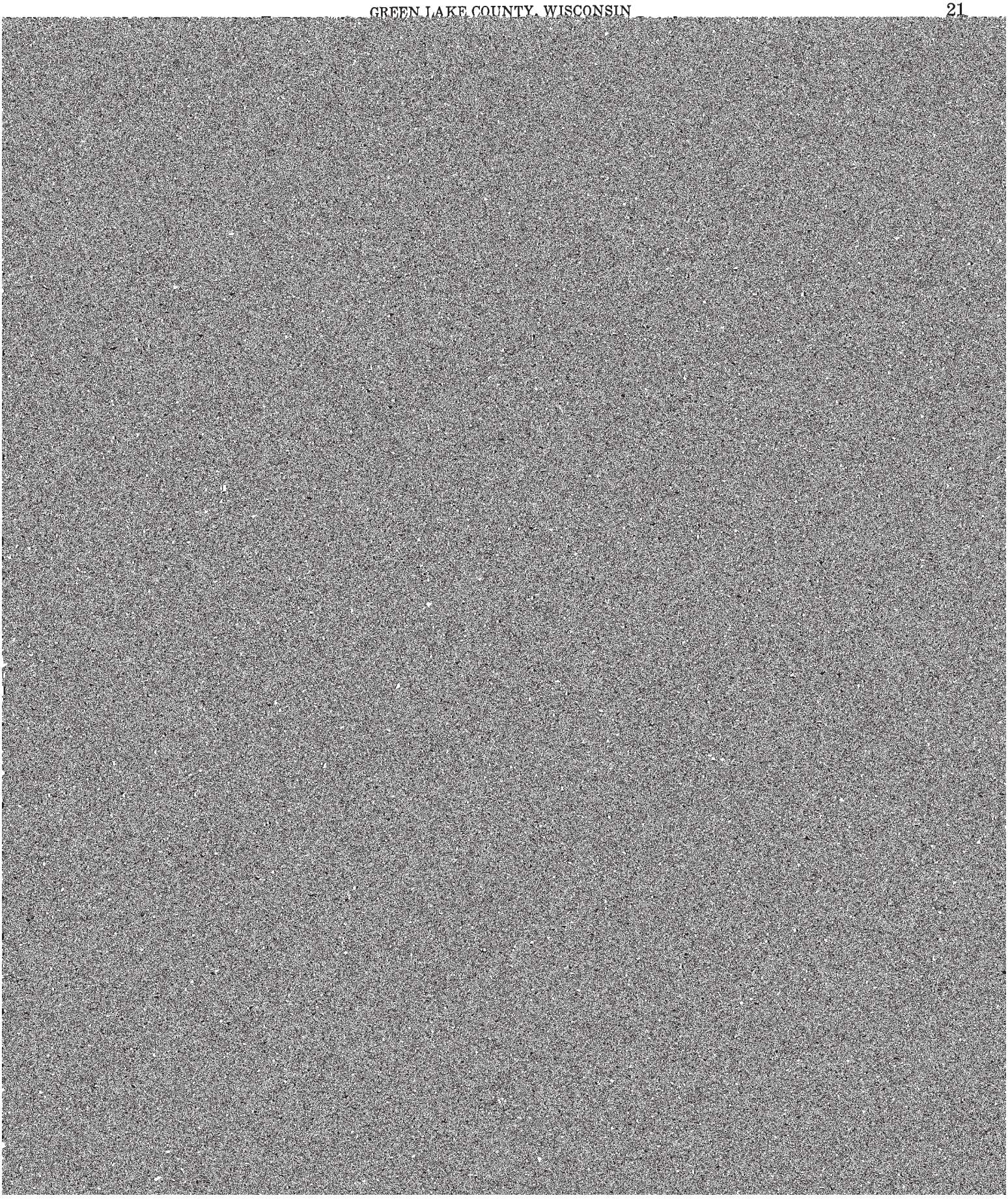
Granby, Loamy Subsoil Variant

The Granby loamy subsoil variant consists of nearly level and gently sloping, poorly drained soils on flood plains and in depressions and old glacial lake basins. These soils are sandy and are underlain by loamy soil. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 11 inches thick. The lower part of the surface layer has light yellowish-brown mottles. The subsoil is about 26 inches thick, and has yellowish-brown mottles. It is pale-brown, light-gray, and light brownish-gray, very friable fine sand in the upper part and light-gray, friable loam in the lower part. The substratum is yellowish-brown, friable sandy loam to a depth of 60 inches. It has light-gray mottles.

The available water capacity is moderate. Permeability is rapid in the upper part of the subsoil and moderate in the lower part of the subsoil and in the substratum. Depth of root penetration is limited by the water table. Natural fertility is low. The [illegible]





for certain vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn, small grains, and hay. Some undrained areas are used for unimproved pasture. Capability unit IIIw–6; woodland group 3w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Grellton Series

The Grellton series consists of nearly level to moderately steep, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

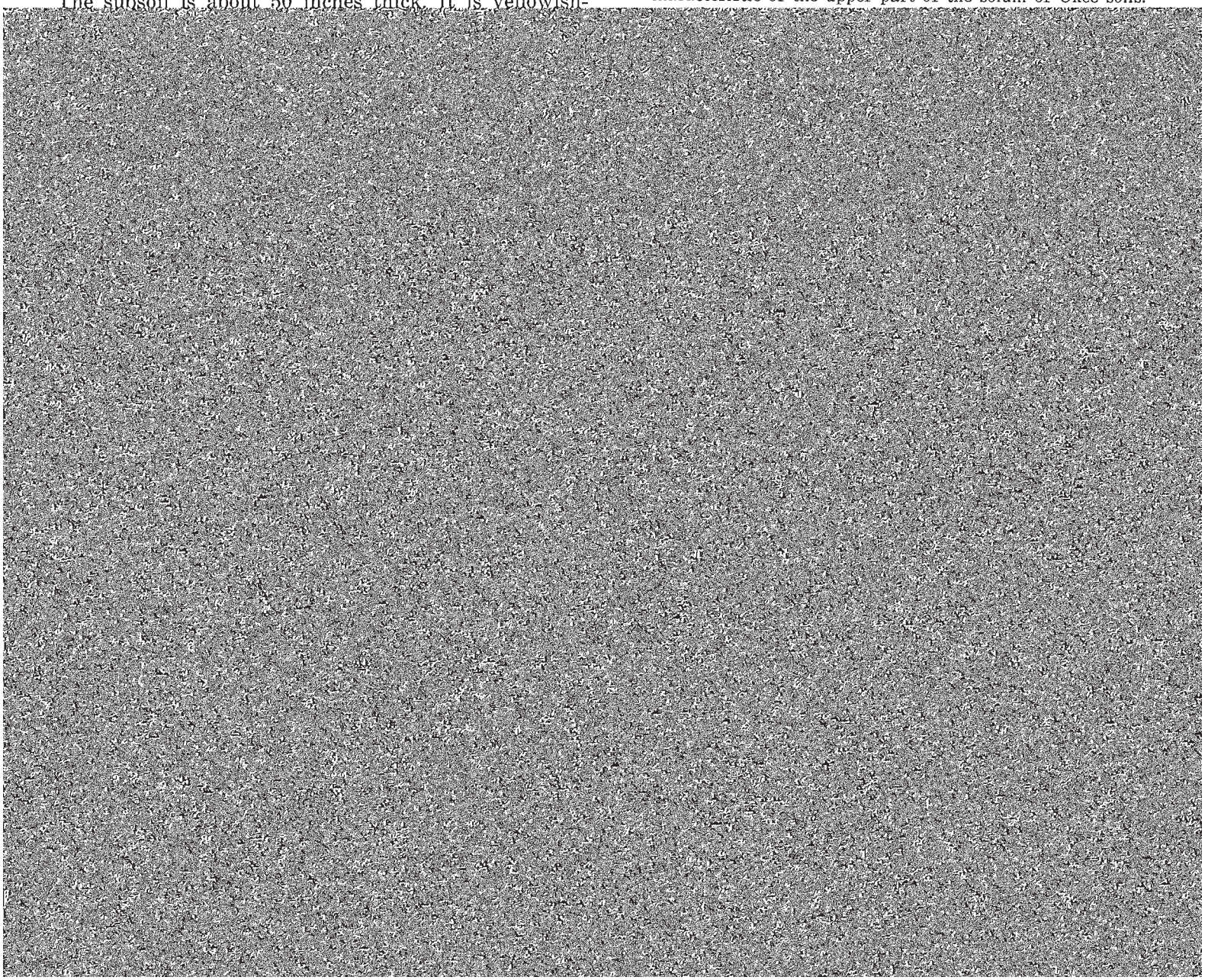
In a representative profile the surface layer is dark grayish-brown fine sandy loam about 6 inches thick. The subsoil is about 50 inches thick. It is yellowish-

on faces of some peds; neutral; gradual, wavy boundary.

IIIC—56 to 60 inches, brown (7.5YR 4/4) gravelly sandy loam; massive; very friable; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 29 percent.

The solum is 42 to 72 inches thick and overlies calcareous, gravelly sandy loam glacial till. In some places, the solum does not extend into the underlying till. In these places, the IIIC horizon is brown, yellowish-brown, or light yellowish-brown silt loam. The Ap horizon is dark grayish brown or very dark grayish brown and is 5 to 8 inches thick. The B1t horizon is loam or sandy loam 4 to 8 inches thick. The B2t horizon is loam, clay loam, sandy clay loam, or heavy sandy loam 12 to 36 inches thick. Gravel in the IIIC horizon ranges from 5 to 25 percent, by volume. Some areas of these soils are mottled in the middle and lower parts of the B horizon and in the C horizon.

Grellton soils are near Kidder, Okee, and Rotamer soils. They have a thicker solum than Kidder and Rotamer soils and have a silt loam IIB horizon which Kidder and Rotamer soils lack. They lack the 20– to 40–inch sand or loamy sand characteristic of the upper part of the solum of Okee soils.



slopes, eroded. This soil is sloping and is on the side slopes adjacent to drainageways of till plains. Most areas are elongated and cover 3 to 30 acres.

This soil has a surface layer that is about 4 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Okee and Rotamer soils and small areas of gently sloping or moderately steep and uneroded and severely eroded Grellton fine sandy loam. In some areas the surface layer is silt loam, loam, loamy fine sand, or fine sand. Also included are areas where this soil is underlain by stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate. During dry periods, this soil is subject to soil blowing.

With proper management, this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. The main areas of

matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Griswold silt loam, 2 to 6 percent slopes, 1,260 feet east and 330 feet south of the center of sec. 2., T. 16 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; very friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil from the A3 horizon mixed in by plowing; mildly alkaline; abrupt, smooth boundary.

A3—8 to 12 inches; very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; common roots; common pores; some very dark brown (10YR 2/2) soil material in worm and root channels; neutral; abrupt, smooth

Capability unit I–4; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

GrB—Griswold silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on the valley floors and broad ridgetops of till plains. Areas are irregular in shape and cover 3 to 180 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Rotamer soils and small areas of nearly level or sloping and eroded Griswold silt loam. In some places the surface layer is fine sandy loam, or the coarse fragments in the underlying till are mostly angular dolomite, or the substratum is sand or stratified sand and gravel, or dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good tilth, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

GrC2—Griswold silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on the side slopes of

The available water capacity is very high, and permeability is rapid in the organic layers. Depth of root penetration is limited by the water table. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

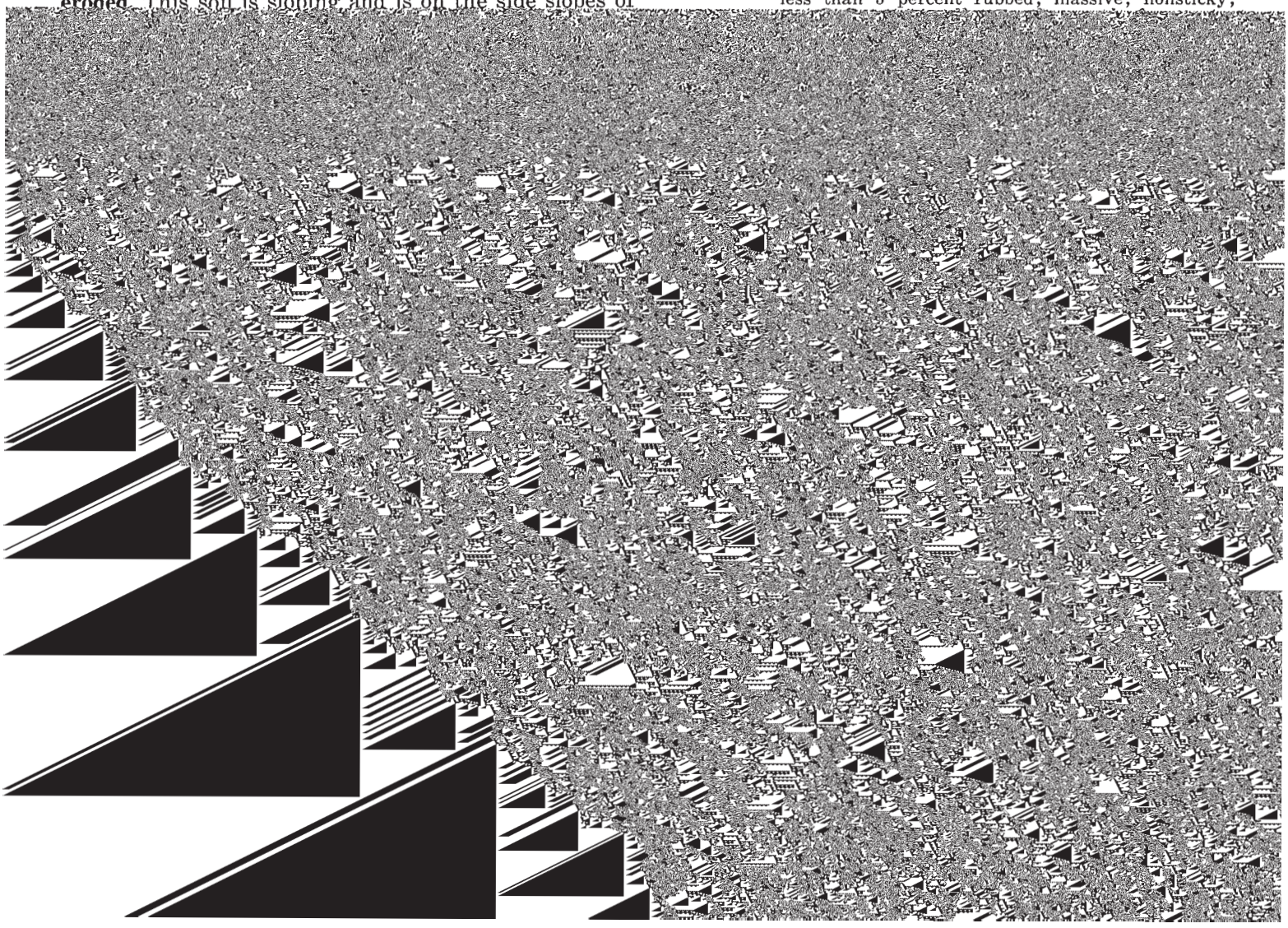
Representative profile of Houghton muck, approximately 200 feet west and 660 feet north of the southeast corner of the NE¼ of sec. 8, T. 15 N., R. 12 E., in a cultivated field:

Oap—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; less than 5 percent fiber, a trace rubbed; weak, fine, granular structure; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; slightly acid; abrupt, smooth boundary.

Oa2—8 to 14 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, fine, granular structure; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; neutral; clear, smooth boundary.

Oa3—14 to 30 inches, black (N 2/0, broken face and rubbed) sapric material; about 15 percent fiber, 5 percent rubbed; massive; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; neutral; gradual, smooth boundary.

Oa4—30 to 40 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, less than 5 percent rubbed; massive; nonsticky;



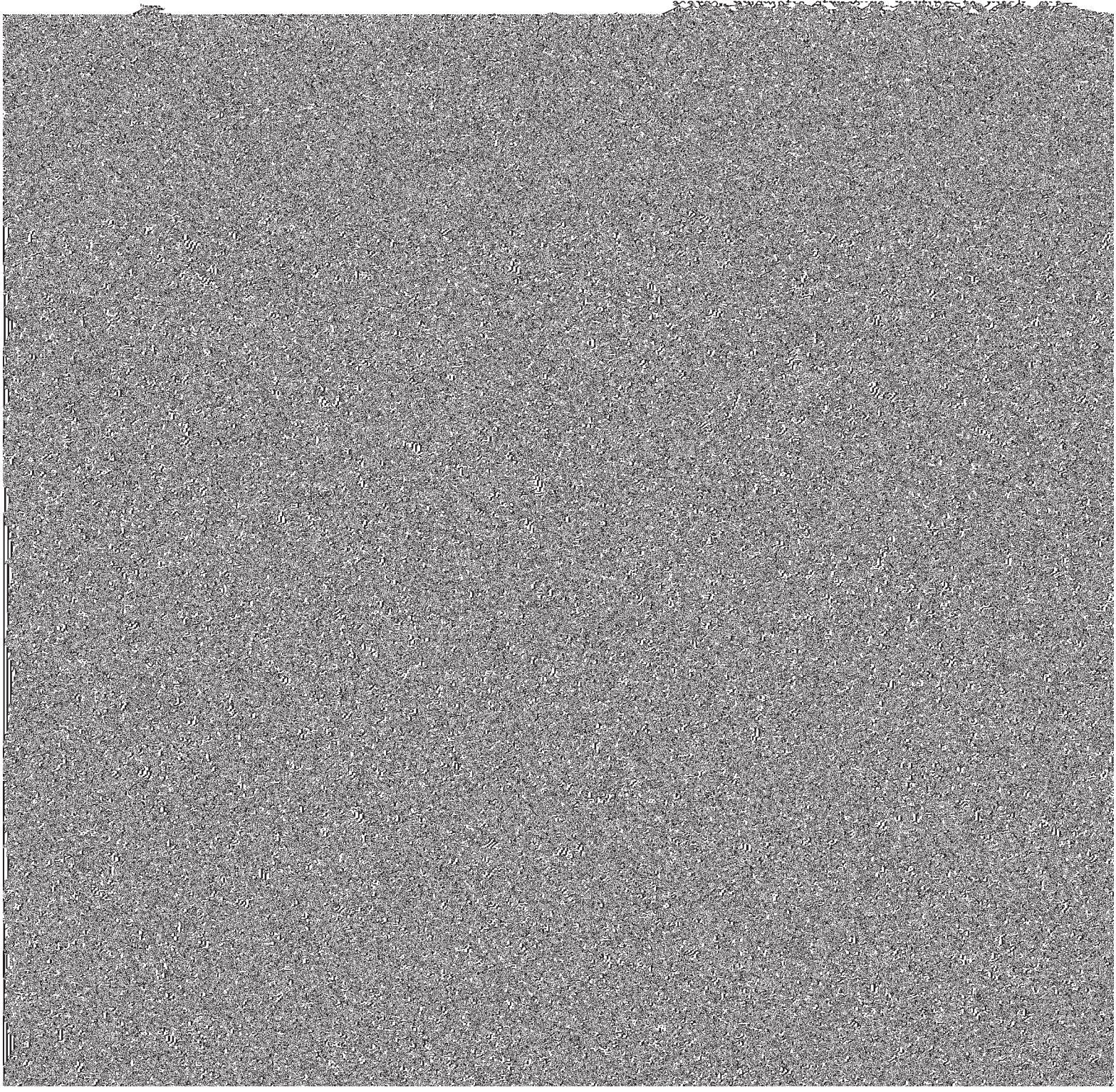
problem. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Drained areas of this soil are suitable for certain vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn. Capability unit IIIw–9; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

dry, silt coatings on faces of some peds; strongly acid; gradual, wavy boundary.

B24—41 to 57 inches, mixed yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) heavy silt loam; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; friable; common pores; strongly acid; gradual, wavy boundary.

B3—57 to 65 inches, light brownish-gray (2.5Y 6/2) silt loam; many, fine and medium, prominent, strong-brown (7.5YR 5/6) mottles and few, fine, prominent, reddish-brown (5YR 4/4) mottles; weak, coarse, prismatic structure parting to weak, [illegible]



In a representative profile the surface layer is very dark grayish-brown loam about 9 inches thick. The subsurface layer is brown loam about 4 inches thick and has yellowish-brown, grayish-brown, and light brownish-gray mottles. The subsoil is about 23 inches thick and has brown, yellowish-brown, and grayish-brown mottles. It is brown, firm loam in the upper part; brown, firm clay loam in the middle part; and yellowish-brown, very friable silt loam in the lower part. The substratum is brown, very friable, stratified silt and very fine sand to a depth of 60 inches. It has yellowish-brown and grayish-brown mottles.

The available water capacity is high, and permeability is moderate. The depth of root penetration is limited by saturated soil during wet periods. Natural fertility is high. The organic-matter content of the surface layer is moderate.

Where drained, most of the acreage is used for corn, small grains, legumes, and other crops grown in the county. Undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Kibbie loam, 0 to 3 percent slopes, approximately 400 feet east and 1,060 feet north of southwest corner of sec. 23, T. 16 N., R. 13 E., in a formerly cultivated field:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine and very fine, granular structure; friable; many roots; common pores; mildly alkaline; abrupt, smooth boundary.

A2—9 to 13 inches, brown (10YR 5/3) loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, faint, light brownish-gray (2.5Y 6/2) and grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; mildly alkaline; clear, smooth boundary.

B21t—13 to 21 inches, brown (10YR 4/3) heavy loam; common, medium, faint, brown (10YR 5/3) mottles, few, fine, faint, grayish-brown (10YR 5/2) mottles, and common, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; common roots; common pores; many thin clay films on faces of peds; medium acid; gradual, wavy boundary.

B22t—21 to 33 inches, brown (10YR 4/3) light clay loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and few, fine, faint, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; common pores; many thin clay films on faces of peds; neutral; clear, smooth boundary.

IIB3t—33 to 36 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles, few, fine, distinct, grayish-brown (10YR 5/2) mottles, and few, fine, prominent, yellowish-brown (10YR 5/8) mottles; weak, fine, subangular blocky structure; very friable; common pores; many thin clay films on faces of peds; mildly alkaline; clear, wavy boundary.

IIC—36 to 60 inches, brown (10YR 5/3) stratified silt and very fine sand; common, fine and medium, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; very friable; common pores; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick, and the depth to carbonates is 24 to 40 inches. The Ap or A1 horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is loam, clay loam, or sandy clay loam 12 to 25 inches thick. The IIB3t horizon is loam or silt loam, and in some places it has thin strata of silt and very fine sand. The IIC horizon is stratified silt and very fine sand, and in some places it contains strata of fine sand, silty clay loam, or silt loam.

Kibbie soils are near Colwood and Sisson soils. Kibbie soils are somewhat poorly drained, Colwood soils are poorly drained, and Sisson soils are well drained.

KbA—Kibbie loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is on flood plains and in depressions and old glacial lake basins. The areas of the soil are irregular in shape and cover 3 to 60 acres.

Included with this soil in mapping are small areas of Colwood and Sisson soils. In some places the surface layer is fine sandy loam or loamy fine sand or this soil is underlain by sand, stratified sand and gravel, or stratified lacustrine silt and clay.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded in some areas during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Care must be taken to prevent loose sand from entering tile lines.

Where properly managed, this soil is suitable for certain vegetable crops. Undrained areas are suitable for wildlife habitat. Where this soil is drained, it is used for most of the farm crops commonly grown in the county. Some undrained areas are used for unimproved pasture. Capability unit IIw–2; woodland group 1o2; recreation group 6; wildlife group 6; tree and shrub group 3.

Kidder Series

The Kidder series consists of nearly level to steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 8 inches thick. The subsoil is about 26 inches thick. It is brown, friable fine sandy loam in the upper part; brown, firm sandy clay loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is yellowish-brown, friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage of the nearly level to sloping soils is used for corn, small grains, legumes, and other crops grown in the county. Most of the moderately steep and steep acreage is used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Kidder fine sandy loam, 2 to 6 percent slopes, approximately 1,290 feet west and 450 feet south of the northeast corner of the SE¼ of sec. 3, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine and medium, granular structure; friable; few roots; common pores; some brown (10YR 4/3) subsoil material mixed in by plowing; medium acid; abrupt, smooth boundary.

B1—8 to 11 inches, brown (10YR 4/3) fine sandy loam; weak, fine, subangular blocky structure; friable;

few roots; common pores; some dark grayish-brown (10YR 4/2) soil material in old root and worm channels; slightly acid; clear, smooth boundary.

B21t—11 to 26 inches, brown (7.5YR 4/4) sandy clay loam; weak, fine and medium, subangular blocky structure; firm; few roots; common pores; thin discontinuous clay films on faces of peds and clay flows in old root channels and in pores; neutral; gradual, smooth boundary.

B22t—26 to 34 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure;

boulders are on the surface and throughout the surface layer and subsoil; or the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight. During dry periods this soil is subject to soil blowing.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the

This soil is best suited to pasture, woodland, or close-growing crops. Most of the acreage is used for pasture or woodland and some is used for row crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–1; woodland group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeA—Kidder loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 30 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Marcellon and Okee soils, small areas of gently sloping Kidder loam, and areas where the surface layer is fine sandy loam. In some places cobbles and boulders are on the surface and throughout the surface layer and subsoil; the entire subsoil is sandy loam; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is slow. This soil has few limitations.

This soil is suitable for all of the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped

areas of gently sloping or moderately steep and uneroded and severely eroded Kidder loam. In some places the surface layer is fine sandy loam; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

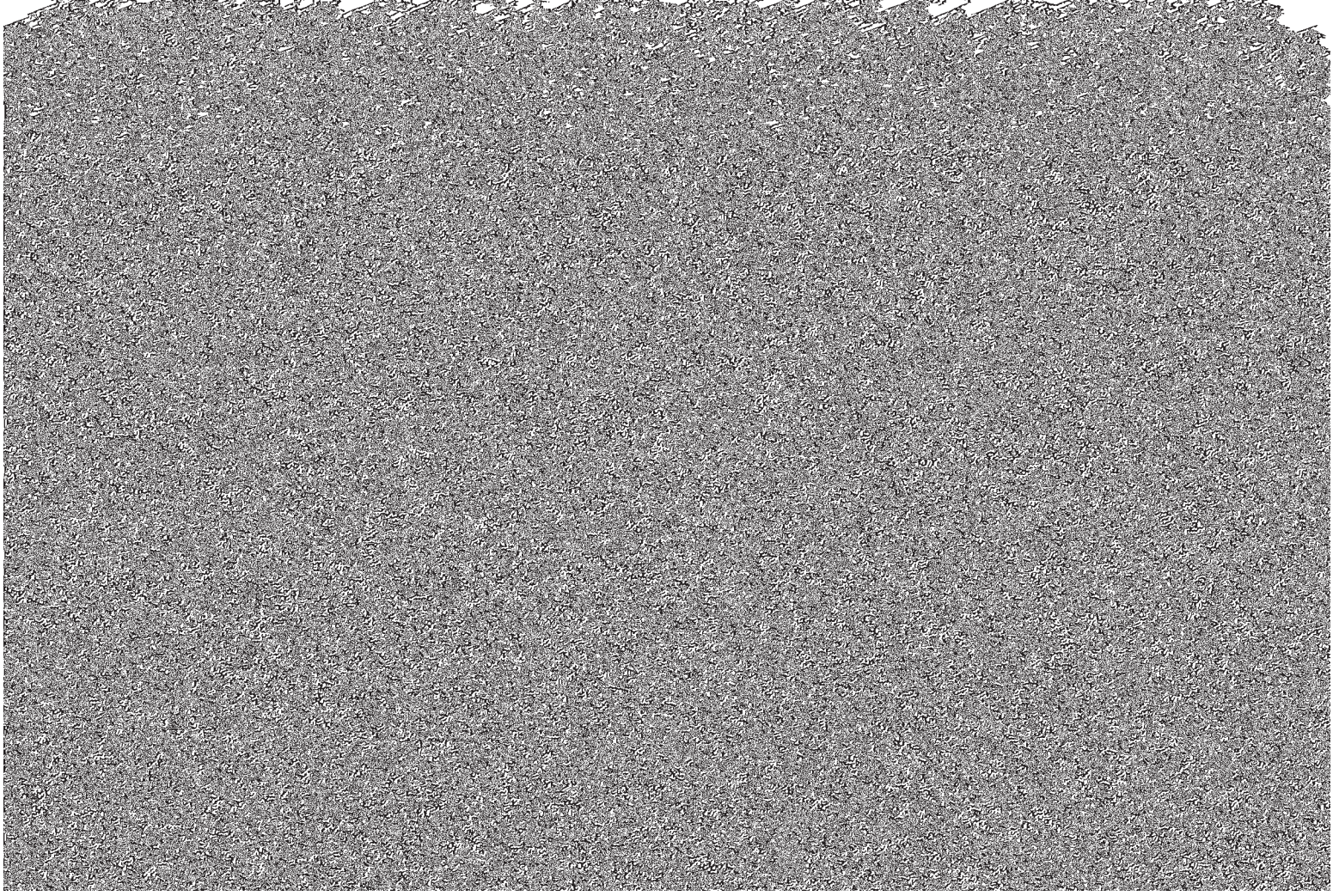
Runoff is medium, and the hazard of erosion is moderate.

This soil is suitable for all of the farm crops and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeD2—Kidder loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on the moraines and along drainageways of till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines and cover 3 to 50 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer and Okee soils, and small areas of sloping or steep and uneroded or severely eroded Kidder loam. In some places the surface layer is fine sandy loam;



land group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Knowles Series

The Knowles series consists of nearly level to moderately steep, well-drained soils on broad ridgetops and side slopes. These soils are loamy and are underlain by dolomite bedrock. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 28 inches thick. It is yellowish-brown, firm silt loam in the upper part; yellowish-brown, firm silty clay loam in the middle part; and dark

IIB25t—33 to 35 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; few pores; about 10 percent, by volume, is gravel of mixed origin, mainly quartzite and chert; thin patchy clay films on faces of peds and on pebbles; mildly alkaline; abrupt, irregular boundary.

IIIR —35 inches, very pale brown (10YR 7/3) creviced dolomite bedrock.

The solum is 20 to 40 inches thick and overlies dolomite. The silty eolian mantle is 18 to 38 inches thick. The Ap horizon is grayish brown or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is heavy silt loam or silty clay loam 9 to 24 inches thick. The IIB2t horizon is sandy clay loam, clay loam, or loam 2 to 10 inches thick. The dolomite bedrock is creviced in most places. Material from the IIB horizon fills these crevices in many places.

Knowles soils are near Dodge, Lomira, and Ripon soils.

of Kidder, Mecan, Oakville, Okee, and Rotamer soils and small areas of nearly level or sloping or eroded Lapeer loamy fine sand. In some places the surface layer is fine sandy loam or sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is slight. During dry periods this soil is subject to soil blowing.

This soil is suitable for all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

[illegible]

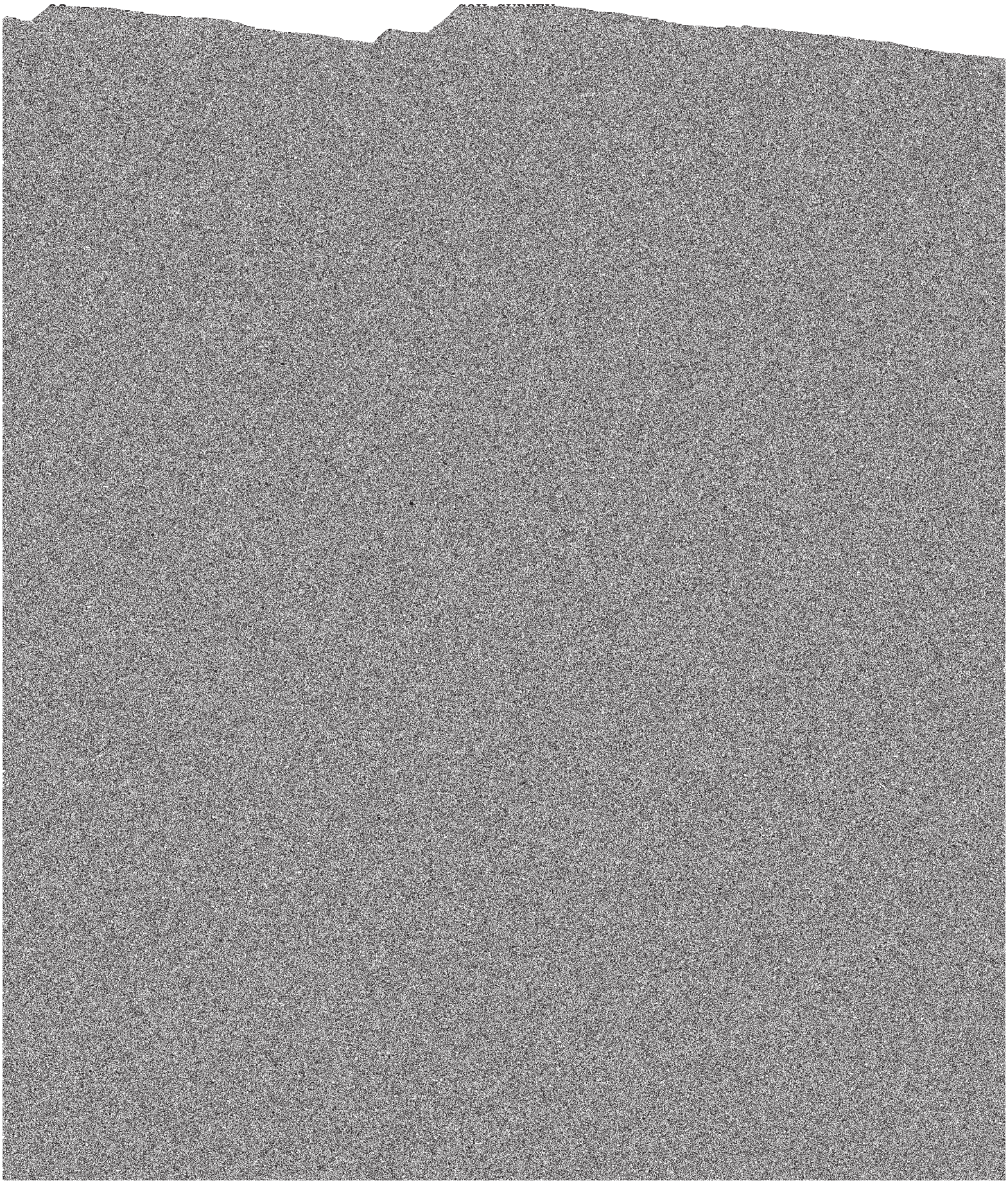
severe. During dry periods this soil is subject to soil blowing.

This soil is best suited to woodland. It is generally not suited to cultivated crops. Most of the acreage is in hay, pasture, or native woodland. Many areas that were once cultivated are now in pasture or woodland. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIe–4; woodland group 3r1; recreation group 2; wildlife group 1; tree and shrub group 1.

Lb—Lapeer fine sandy loam, 0 to 2 percent slopes. This soil is nearly level and is on valley floors and broad ridgetops of the till plains. Areas are irregular in shape and cover 3 to 40 acres.

This soil has a surface layer about 4 to 6 inches thicker and darker colored than the surface layer of the soil described as representative of the series.

Included with this soil in mapping are small areas [illegible]



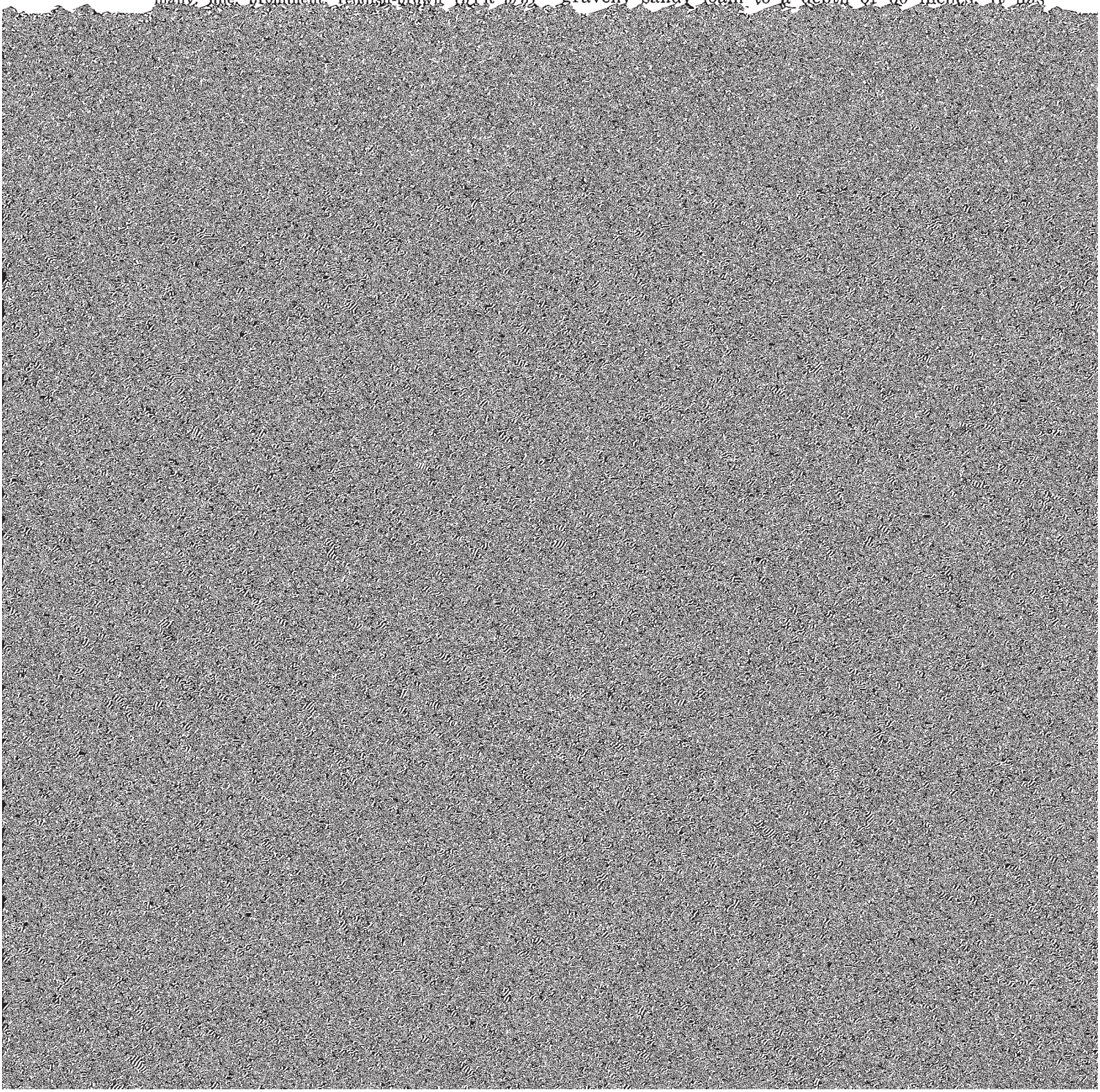
2(1) clay films on faces of some peds and in old

LvD2—Lomira silt loam, 12 to 20 percent slopes,

B21t—9 to 16 inches, reddish-brown (5YR 4/4) clay; few, fine, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; firm; few roots; common pores; black (N 2/0) soil material in worm channels and on some faces of peds and thin continuous clay films on faces of peds; mildly alkaline; clear, smooth boundary.

B22t—16 to 26 inches, grayish-brown (2.5Y 5/2) clay; many, fine, prominent, reddish-brown (5YR 5/3)

dark grayish-brown loam about 9 inches thick. The subsoil is about 26 inches thick and has brown, yellowish-brown, grayish-brown, and yellowish-red mottles. It is yellowish-brown, firm loam in the upper part; brown, firm clay loam in the middle part; and dark yellowish-brown, friable sandy loam in the lower part. The substratum is yellowish-brown, very friable gravelly sandy loam to a depth of 60 inches. It has



of flood plains and in drainageways and depressions of

This soil has a surface layer that is about 1 inch thicker and the surface layer and subsoil combined are about 4 inches thicker than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Ritchey soils and areas of nearly level or sloping and uneroded or severely eroded Markesan silt loam. Some areas have dolomite fragments on the surface and throughout the surface layer and subsoil. The soil in many of these areas is thinner to glacial till than is typical and lacks subsoil development. Also included subsoil development. Also included are small areas where the underlying till is very gravelly loam. And in places, dolomite is at a depth of 25 to 60 inches.

Runoff is rapid, and the hazard of erosion is severe. In places tillage is hampered by dolomite fragments.

This soil is best suited to pasture or close growing crops. Most of the acreage is used for pasture and some is used for row crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IVe–1; wood-

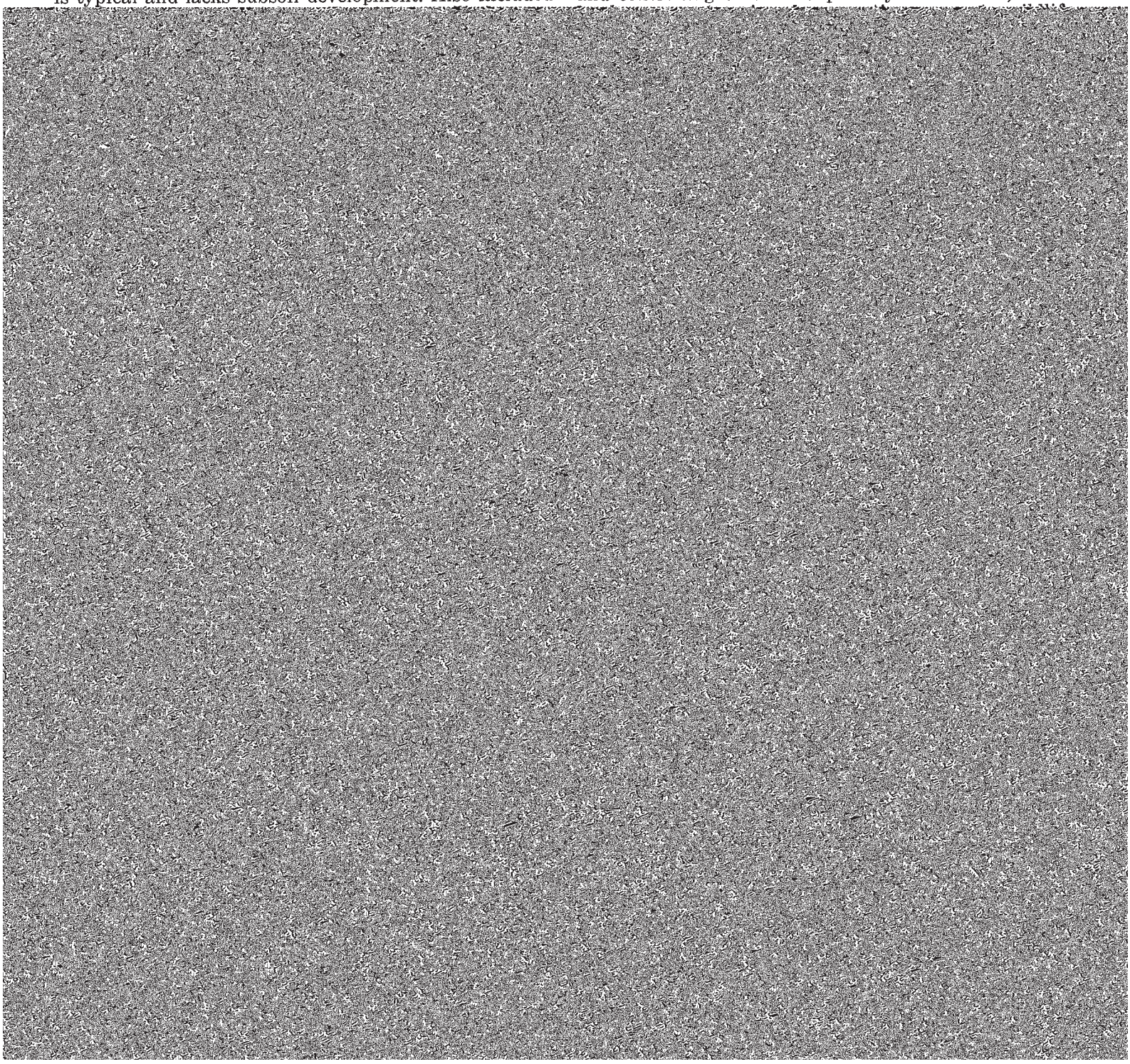


Figure 8.—**Area of Marsh that is wet most of the year. Drainage is not practical.**

sand. Natural fertility is medium. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn

lowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common pores; slightly acid; gradual, wavy boundary.

old glacial lake basins. Areas are irregular in shape and cover 3 to 160 acres.

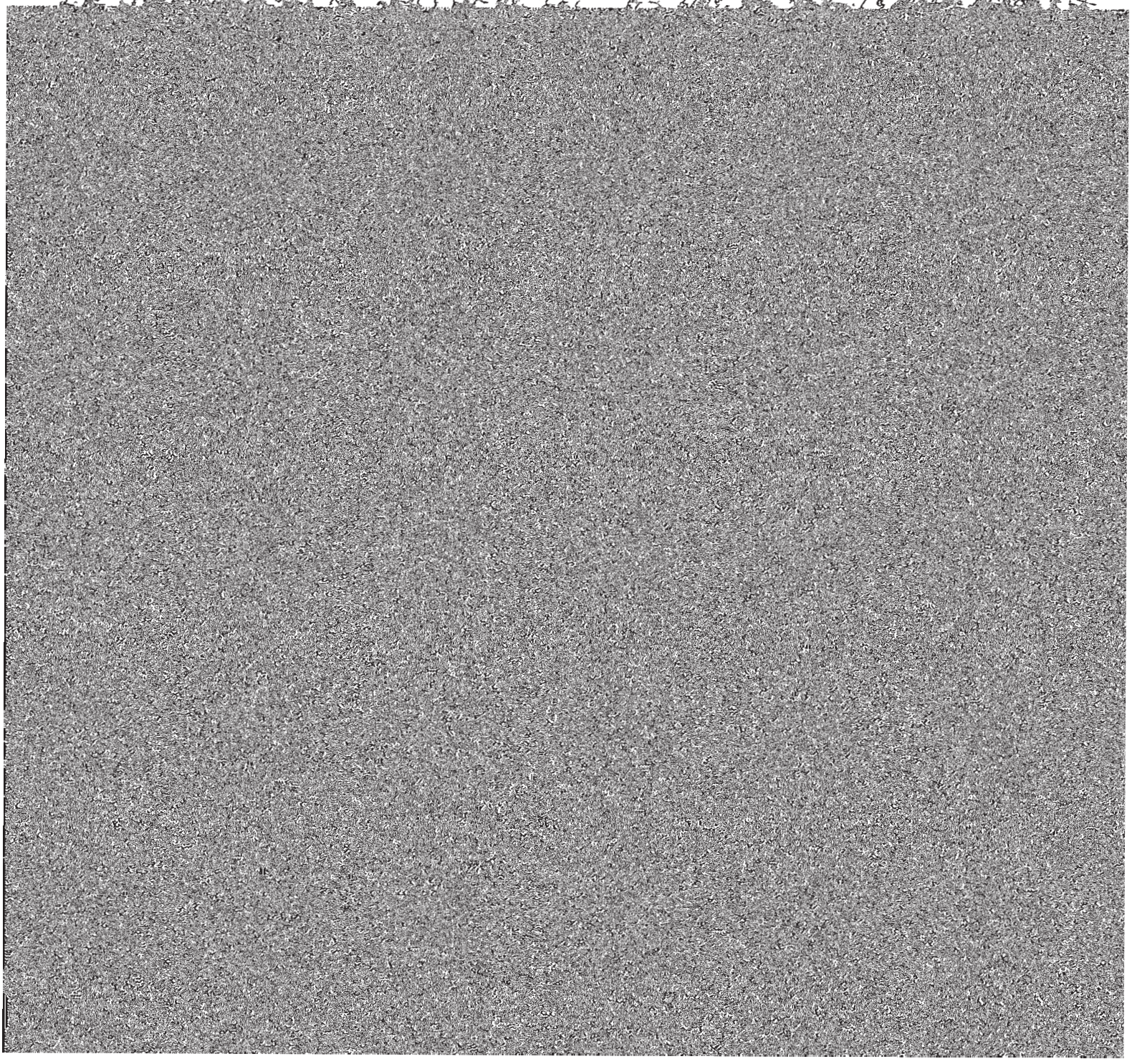
Included with this soil in mapping are small areas of Adrian, Barry, Colwood, Ossian, and Palms soils. In some small areas the surface layer is organic and is as much as 16 inches thick or thin loamy strata are in the underlying sand.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both

when dry, silt coatings on faces of some peds; thin patchy clay films on faces of some peds and in pores and channels; clay bridging between sand grains; slightly acid; gradual, wavy boundary.

B23t—35 to 42 inches, brown (7.5YR 4/4) heavy sandy loam; moderate, medium, subangular blocky structure; friable; few pores; very pale brown (10YR 8/3), when dry, silt coatings on faces of most peds and thin patchy clay films on faces of some peds and in pores and channels; clay bridging between sand grains; slightly acid; clear, smooth boundary.

B24t—42 to 46 inches, brown (7.5YR 4/4) sandy loam; weak, medium, subangular blocky structure; friable; few pores; clay bridging between sand



fine sand; and areas that have slopes as much as 20 percent. In some places the surface layer is fine sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil or a thin layer of stratified sand and gravel is below the subsoil and above the till.

Runoff is medium. The hazard of erosion is moderate. This soil is subject to soil blowing.

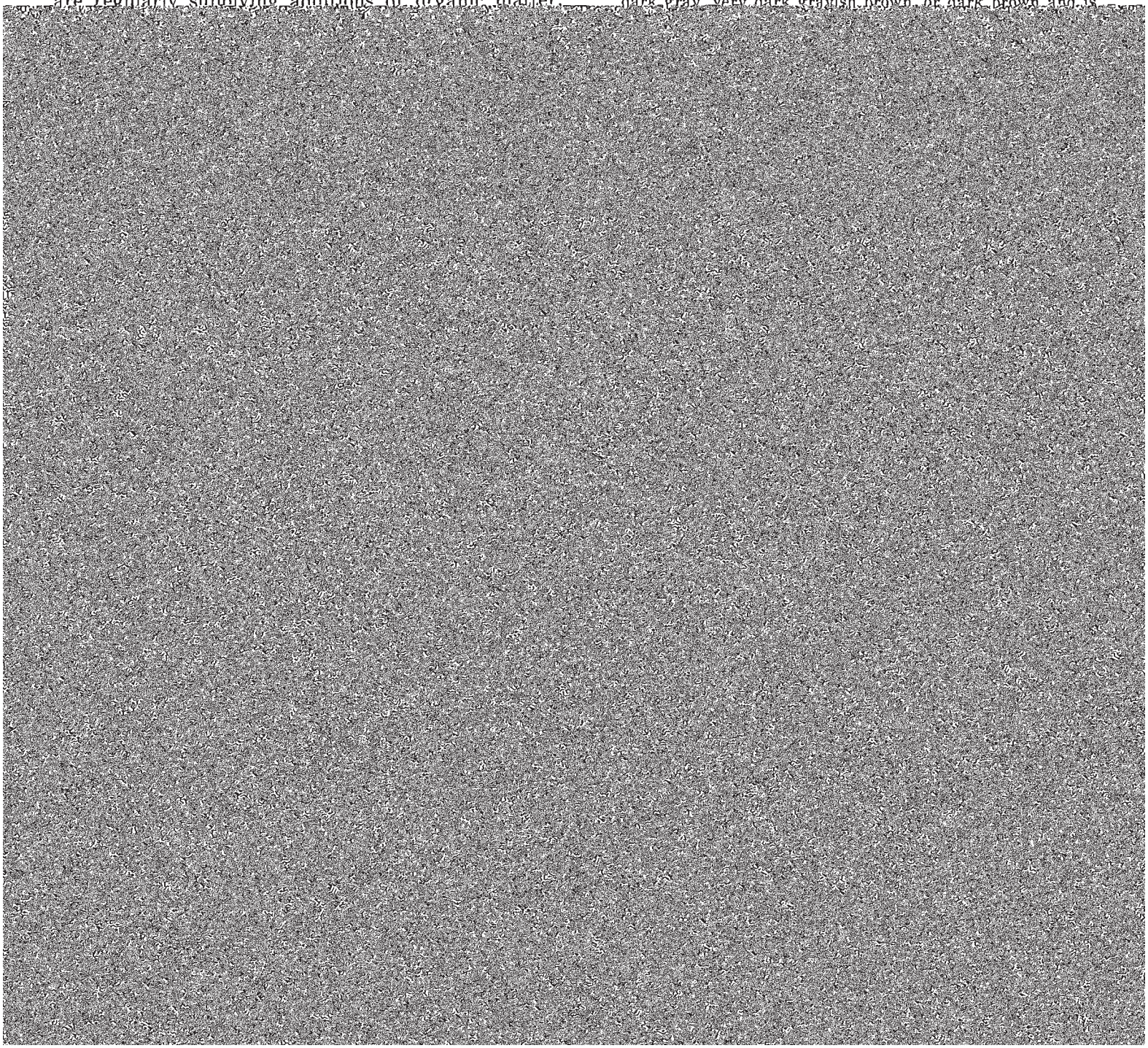
Where managed properly, this soil is suitable for all of the farm crops commonly grown in the county. Most of the acreage is used for general farm crops and some is in native woodland. Some has been planted to pine trees. The main concerns of management are regularly supplying additions of organic matter

and channels; slightly acid; clear, smooth boundary.

IIB3—30 to 33 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, medium, subangular blocky structure; very friable; about 25 percent gravel, by volume, mostly dolomite fragments; strong effervescence; mildly alkaline; clear, wavy boundary.

IIC—33 to 60 inches, pale-brown (10YR 6/3) very gravelly sandy loam; massive; very friable; about 60 percent gravel, by volume, mostly dolomite fragments; violent effervescence; moderately alkaline; calcium carbonate equivalent is 85 percent.

The solum is 24 to 40 inches thick and overlies calcareous, very gravelly sandy loam till. The silty eolian mantle is 20 to 36 inches thick. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is black, very dark brown, very dark gray, very dark grayish brown, or dark brown and is



eroded. This soil is sloping and is on side slopes of broad ridges on till plains. Most areas are elongated to irregular in shape and cover 3 to 30 acres.

This soil has a surface layer that is 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of gently sloping and uneroded or severely eroded Mendota silt loam. In small areas dolomite fragments are on the surface and throughout the surface layer and subsoil; the underlying till is very gravelly loam; or the till contains less than 30 percent gravel, by volume.

Runoff is medium, and the hazard of erosion is moderate.

With proper management this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth,

sand; single grained; loose; few roots; slightly acid; clear, smooth boundary.

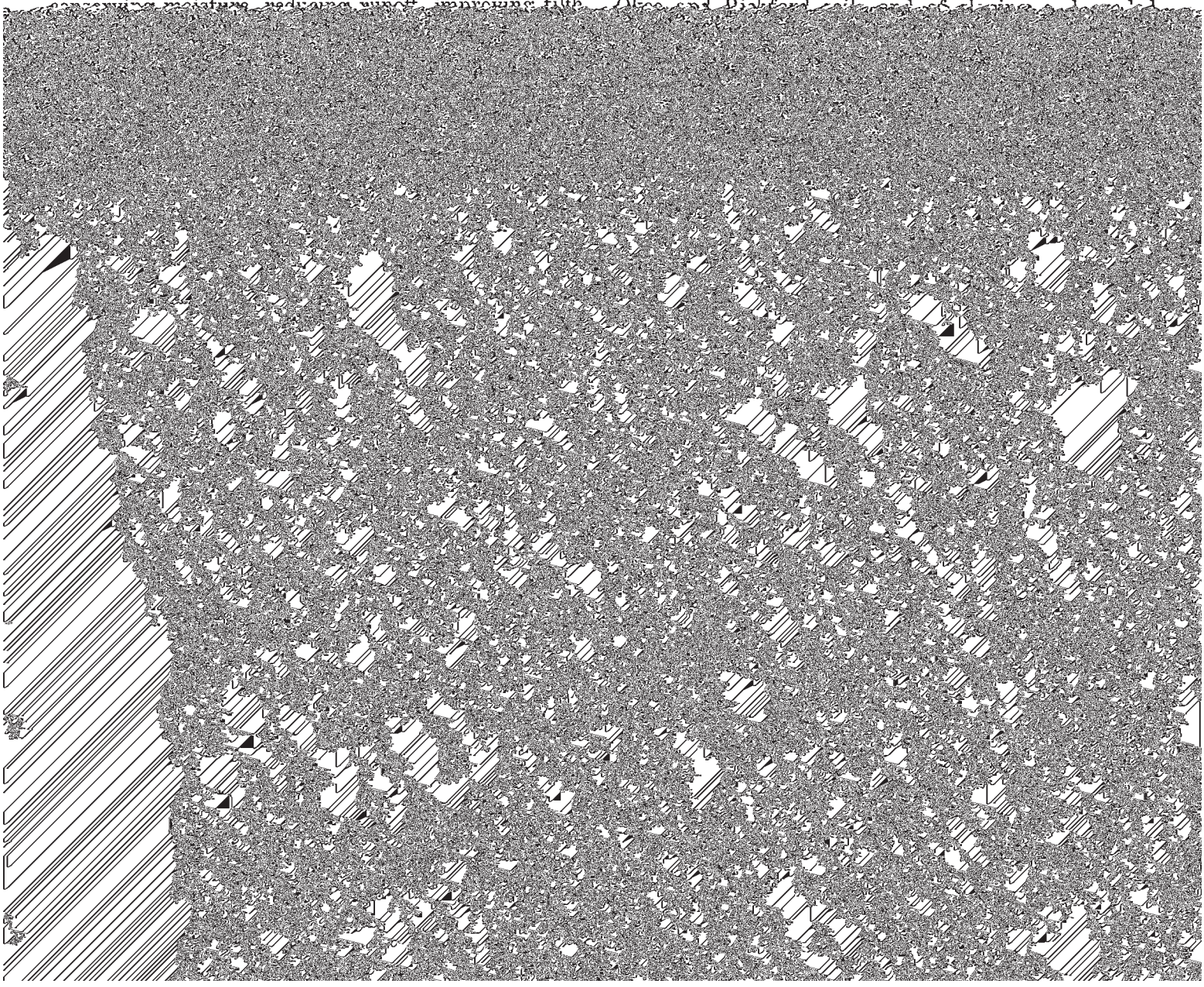
C3—53 to 60 inches, pale-brown (10YR 6/3) medium sand; single grained; loose; medium acid.

Solum is 20 to 40 inches thick and averages between 50 and 90 percent fine sand and as much as 25 percent very fine sand. The Ap horizon is brown, dark grayish brown, or very dark grayish brown and is 6 to 10 inches thick. The B2 horizon is 10 to 30 inches thick.

Oakville soils are near Brems and Gotham soils. They lack the layer of clay accumulation characteristic of Gotham soils. Oakville soils are well drained, and Brems soils are moderately well drained.

OaB—Oakville fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces and in old glacial lake basins, and some areas are eolian sand deposits on till uplands. Areas are elongated to irregular in shape and cover 3 to 190 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Oh

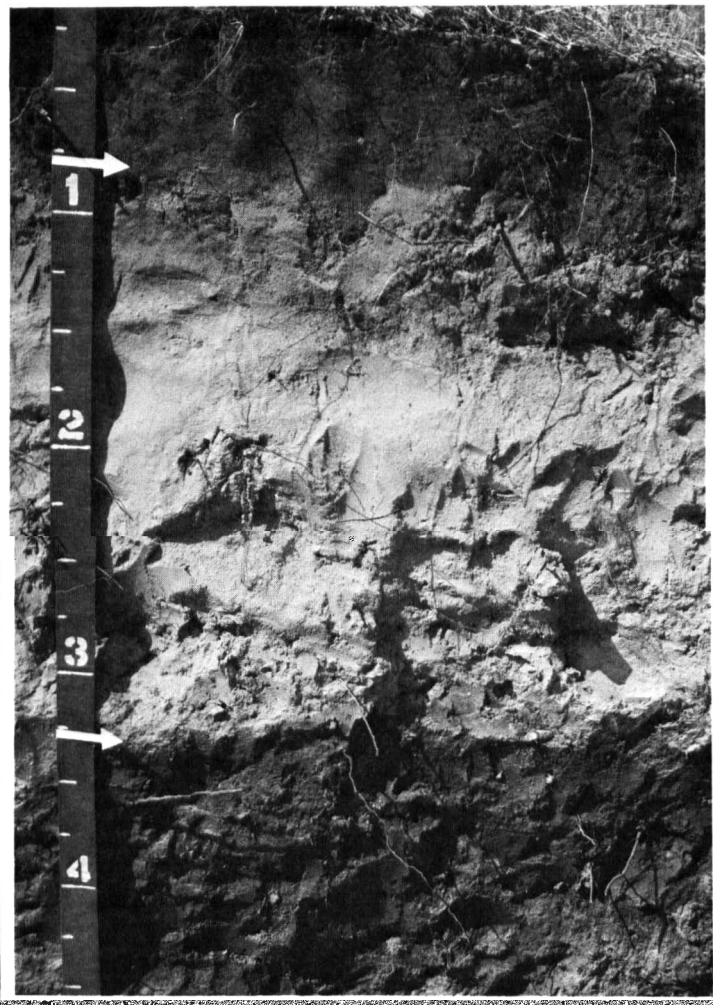


and some have been planted to pine trees. Pasture and hay are best seeded early in spring before the soil has a chance to dry. Later plantings have a poor chance of survival. The main concerns of management are maintaining plant cover and reducing erosion and soil blowing. Capability unit VIs-3; woodland group 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

OaD—Oakville fine sand, 12 to 35 percent slopes. This soil is moderately steep to steep and is on outwash plains and terraces and in old glacial lake basins, and some areas are eolian sand deposits on till uplands. Areas are elongated and cover 3 to 20 acres.

This soil has a surface layer about 2 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer, Okee, and Richford soils and small areas of sloping, eroded, or severely eroded Oakville fine sand.



14 to 30 inches thick. The IIBt horizon is dominantly sandy loam but has thin layers of loam, clay loam, or sandy clay loam in places. It is 15 to 30 inches thick. Coarse fragments, including cobbles and boulders, in the IIC horizon range from 5 to about 25 percent, by volume.

Okee soils are near Grelton, Lapeer, and Mecan soils. They have a 20- to 40-inch thick sandy mantle which Grellton soils lack. They have a thicker sandy mantle than Lapeer and Mecan soils and a thicker solum than Lapeer soils.

OkB—Okee loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on

layers have a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe-7; woodland group 2s1; recreation group 2; wildlife group 1; tree and shrub group 1.

Oshtemo Series

loam but has thin layers of sandy clay loam in some places. It is 15 to 35 inches thick. The B3 horizon is loamy sand or sand 15 to 35 inches thick. Gravel content of the B3 horizon is as much as 25 percent, by volume. In some places there is a thin horizon of clay accumulation directly above the C horizon. The C horizon is dominantly medium and coarse sand but in some places it is stratified sand and gravel.

Oshtemo soils are near Boyer and Richford soils. They have a thicker solum than Boyer soils. They have more clay in the B horizon than Richford soils and have a thinner sandy mantle.

OmB—Oshtemo loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces. Most areas are elongated and cover 3 to 200 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gotham, Oakville, and Richford soils and small areas of sloping and eroded Oshtemo loamy fine sand. In some places the surface layer is fine sandy loam or fine sand. Also included are some small areas that are underlain by gravelly sandy loam till or stratified silt and fine sand.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland. Some has been planted to pine trees. Fertilization, supplemental irrigation, and protection from soil blowing help insure dependable crop

Ossian Series

The Ossian series consists of nearly level, poorly drained soils on flood plains and in old glacial lake basins, drainageways, and depressions on till plains. These soils are loamy and are underlain by silt loam deposits. The native vegetation was mainly marsh grasses, reeds, and sedges. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 18 inches thick and has strong-brown mottles. It is black silt loam in the upper part and very dark gray silt loam in the lower part. The subsoil is about 27 inches thick and has strong-brown and yellowish-brown mottles. It is olive-gray, friable silt loam in the upper part and light olive-gray, very friable silt loam in the lower part. The substratum is light olive gray, very friable silt loam to a depth of 60 inches. It has yellowish-brown and olive-yellow mottles.

The available water capacity is very high, and permeability is moderate. The depth of root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Ossian silt loam approximately 250 feet east and 250 feet south of the northwest corner of the NE¼ of sec. 24, T. 15 N., R. 12 E.

brown (10YR 5/6) and olive-yellow (2.5Y 6/6) mottles; massive; very friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

The solum is 24 to 48 inches thick. Depth to carbonates is 40 to 60 inches. The silty mantle is 40 to 96 inches thick. The dark-colored A horizon is 10 to 24 inches thick. It is black, very dark brown, very dark gray, or very dark grayish brown. The C horizon is silt loam, gravelly sandy loam, or stratified silt, fine sand, and very fine sand.

Ossian soils are near Joy and Plano soils. Ossian soils are poorly drained, Joy soils are somewhat poorly drained, and Plano soils are well drained and moderately well drained.

Os—Ossian silt loam. This soil is nearly level and is on flood plains and in old glacial lake basins, drainageways, and depressions on till plains. Areas are elongated to irregular in shape and cover 3 to 260 acres.

Included with this soil in mapping are small areas of Joy and Palms soils. In some small areas the surface layer is silty clay loam or loam or is muck as much as 16 inches thick; or this soil is underlain by sand, stratified sand and gravel, or gravelly sandy loam till. In drainageways and depressions the surface layer

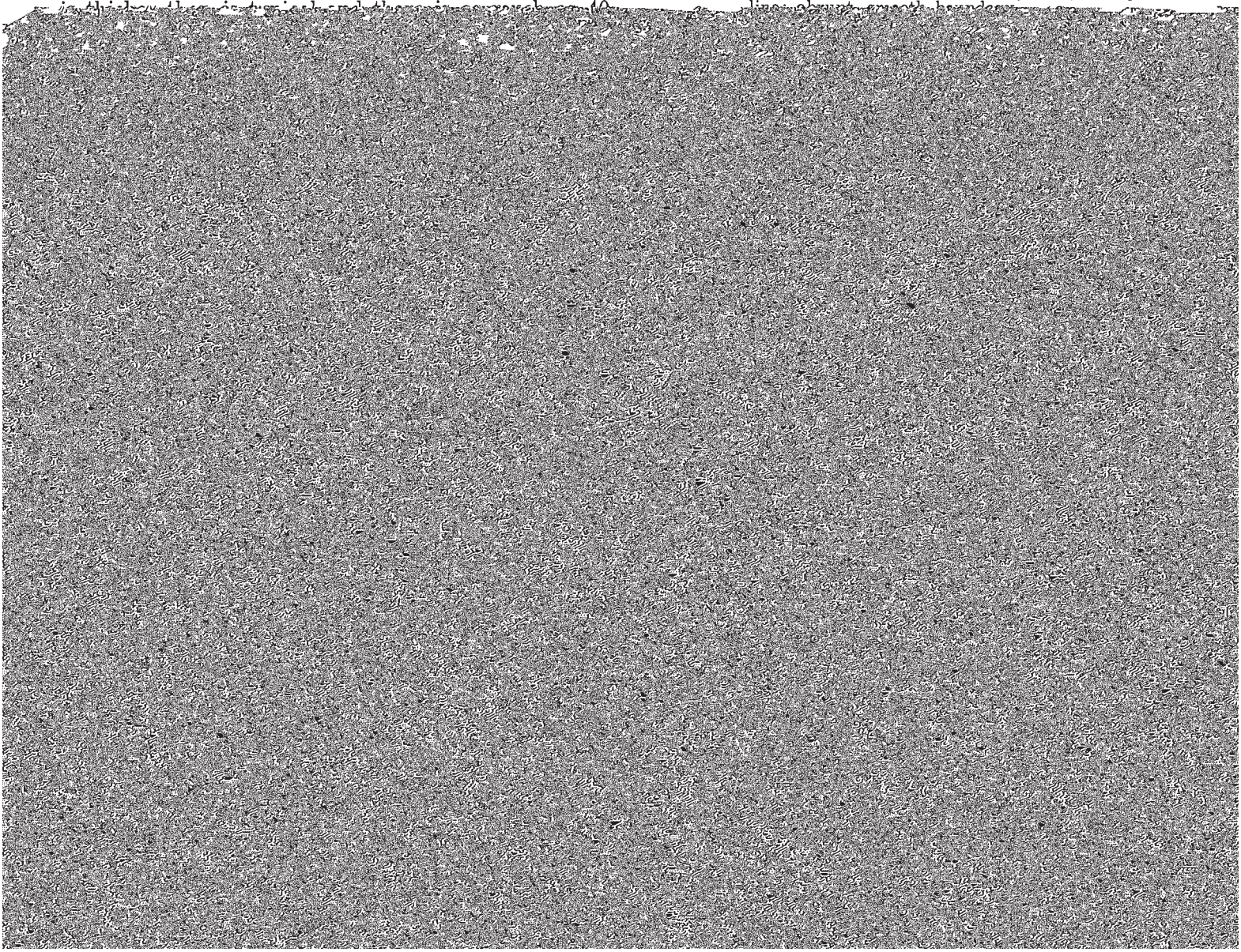
Representative profile of Palms muck, approximately 530 feet south and 920 feet east of the northwest corner of the SW¼ of sec. 20, T. 15 N., R. 12 E., in an uncultivated wetland:

Oa1—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, less than 5 percent rubbed; weak, fine, crumb structure; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; abrupt, smooth boundary.

Oa2—8 to 16 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, thick, platy structure parting to weak, fine and medium, crumb; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; gradual, smooth boundary.

Oa3—16 to 20 inches, black (N 2/0, broken face and rubbed) sapric material; a trace of fiber, none rubbed; weak, fine and medium, crumb structure; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; clear, smooth boundary.

Oa4—20 to 26 inches, black (N 2/0, broken face), black (10YR 2/1, rubbed) sapric material; a trace of fiber, none rubbed; massive; nonsticky; mainly herbaceous fibers; a few thin layers of sand less than ¼ inch thick; about 15 percent mineral matter, by volume, mostly quartz grains; mildly alka-



Where drained, this soil is suitable for certain vege-

cent gravel, by volume; strong effervescence; mod-

ment are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Poy Series

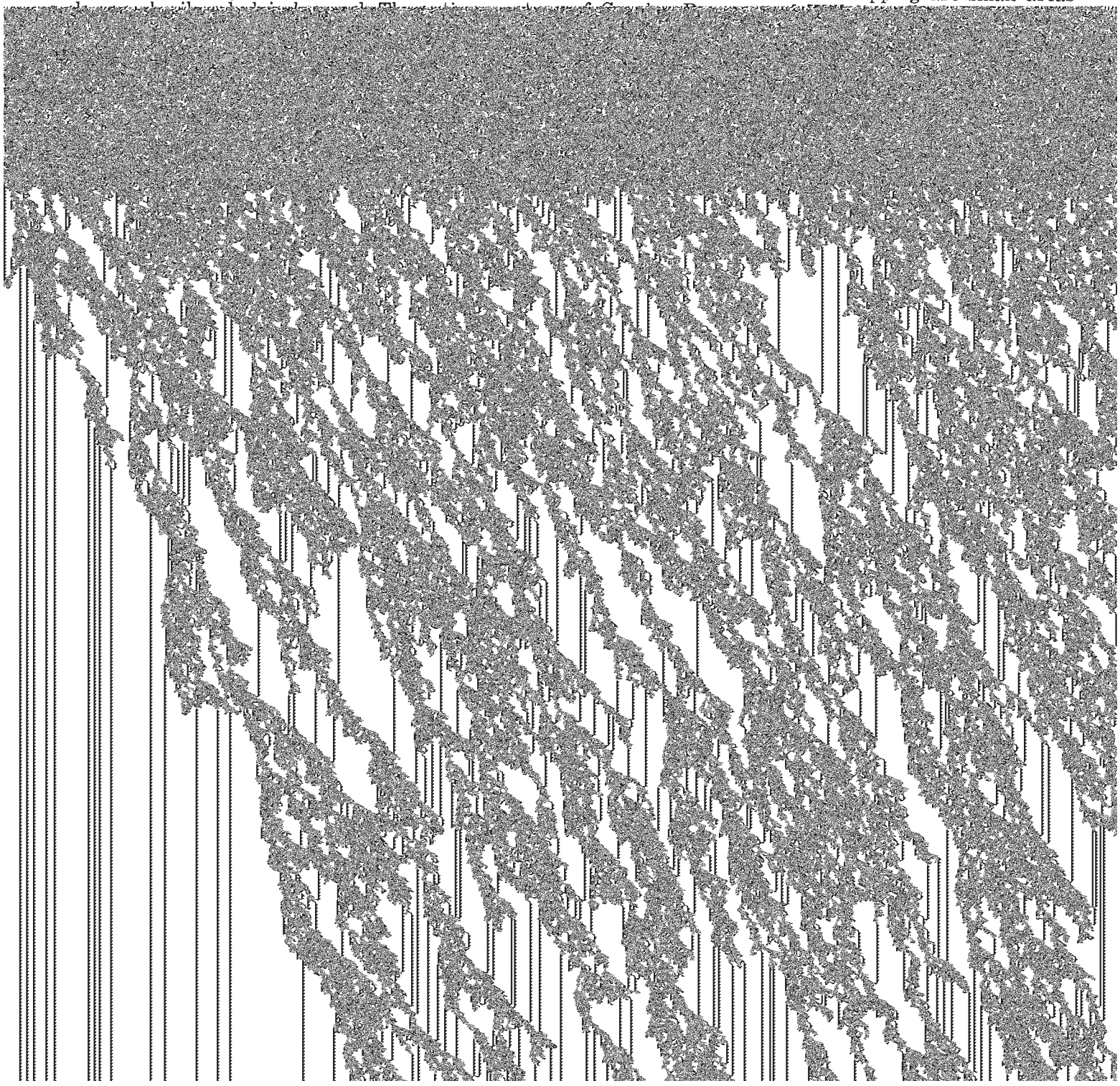
The Poy series consists of nearly level, poorly drained soils in old glacial lake basins. These soils have

brown and is 10 to 15 inches thick. The B2g horizon is clay or silty clay 10 to 32 inches thick.

Poy soils are near Poygan, Willette, and Zittau soils. Poy soils are underlain by sand and Poygan soils by clayey deposits. Poy soils lack the 16– to 50–inch organic layer of Willette soils. Poy soils are poorly drained, and Zittau soils are somewhat poorly drained.

Pr—Poy silty clay loam. This soil is nearly level and is in old glacial lake basins. Areas are irregular in shape and cover 3 to 500 acres.

Included with this soil in mapping are small areas



A12—8 to 12 inches, black (10YR 2/1) silty clay; weak, very fine, subangular blocky structure; firm; few roots; common pores; mildly alkaline; abrupt, smooth boundary.

B21g—12 to 18 inches, gray (5Y 5/1) clay; common, medium, faint, grayish-brown (2.5Y 5/2) mottles and few, medium, prominent, reddish-brown (5YR 5/3) mottles; moderate, very fine, subangular blocky structure; firm; few roots; common pores; some black (10YR 2/1) soil material in old worm and root channels and on faces of some peds; mildly alkaline; clear, smooth boundary.

B22g—18 to 32 inches, brown (7.5YR 5/2) clay; common, fine, prominent, gray (5Y 5/1) mottles; moderate, very fine, angular blocky structure; firm; few roots; common pores; some black (10YR 2/1) soil material in old worm and root channels and on faces of some peds; mildly alkaline; clear, smooth boundary.

C1—32 to 47 inches, reddish-brown (5YR 5/3) silty clay; common, fine, prominent, light-gray (5Y 6/1) mottles; massive; firm; few pores; slight effervescence; moderately alkaline; gradual, smooth boundary.

C2—47 to 60 inches, reddish-brown (5YR 4/3) silty clay; massive; firm; few pores; slight effervescence; moderately alkaline.

The solum is 20 to 36 inches thick, and free carbonates are at a depth of 20 to 36 inches. The dark-colored A horizon is 10 to 18 inches thick. The Ap horizon is black or very dark gray and is 6 to 9 inches thick. The A12 horizon is black or very dark gray silty clay loam or silty clay 4 to 9 inches thick. The B2g horizon is clay or silty clay 8 to 24 inches thick. The C horizon is clay or silty clay.

Most areas of these soils have a dark-colored A horizon that is thicker than is defined as the range for the series. This difference does not alter the usefulness and behavior of the soils.

Poygan soils are near Manawa, Poy, and Willette soils. Poygan soils are poorly drained, and Manawa soils are somewhat poorly drained. Poygan soils lack the sandy C horizon characteristics of Poy soils and the 16- to 50- inch organic layer characteristic of Willette soils.

Py—Poygan silty clay loam. This soil is nearly level and is in old glacial lake basins. Areas are irregular in shape and are mostly 3 to 130 acres in size, but one area exceeds 1,200 acres.

Included with this soil in mapping are small areas of Manawa, Poy, and Willette soils. In some small areas the surface layer is silt loam or loam, or it is organic and is as much as 16 inches thick.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Undrained areas are suitable for wetland wildlife

dark grayish-brown loamy sand about 9 inches thick. The subsoil is about 35 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the middle part; and brown, very friable loamy sand in the lower part. The substratum is brown, loose fine sand in the upper part and yellowish-brown, loose fine sand to a depth of 60 inches.

The available water capacity is low, and permeability is moderately rapid. Natural fertility is low.

Most areas of nearly level to sloping soils are used for corn, small grains, legumes, and pasture. Most areas of moderately steep soils are used for pasture, woodland, or wildlife habitat. Some areas which were once farmed are no longer being actively farmed, and some have been planted to pine trees.

Representative profile of Richford loamy sand, 1 to 6 percent slopes, approximately 140 feet north and 1,190 feet west of the southeast corner of the NE¼ of sec. 1, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy sand; weak, medium, granular structure; very friable; common roots; many pores; slightly acid; abrupt, smooth boundary.

B1—9 to 29 inches, brown (7.5YR 5/4) loamy sand; very weak, fine, subangular blocky structure, single grained where disturbed; very friable; few roots; many pores; slightly acid; abrupt, smooth boundary.

IIB2t—29 to 37 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; few roots; many pores; thin discontinuous clay films on faces of peds; about 5 percent gravel, by volume; medium acid; clear, smooth boundary.

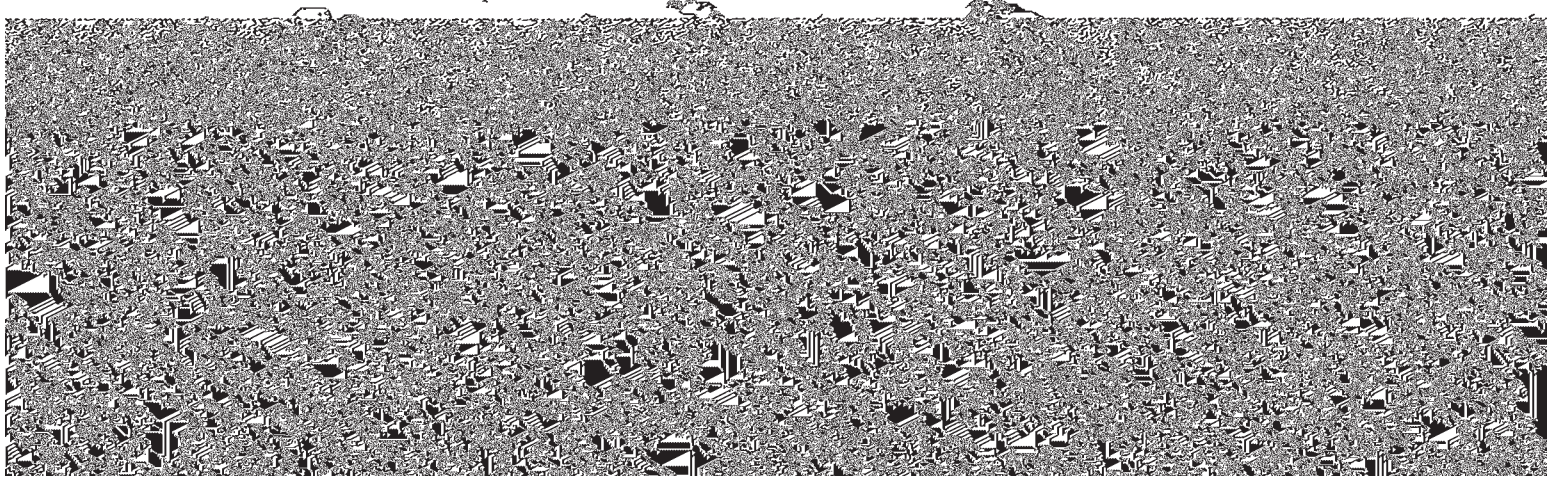
IIIB3t—37 to 44 inches, brown (7.5YR 4/4) light loamy sand; very weak, medium, subangular blocky structure, single grained where disturbed; very friable; few roots; many pores; medium acid; gradual, wavy boundary.

IIIC1—44 to 49 inches, brown (10YR 5/3) fine sand; single grained; loose; neutral; gradual, smooth boundary.

IIIC2—49 to 60 inches, yellowish-brown (10YR 5/4) fine sand; single grained; loose; neutral.

The solum is 30 to 50 inches thick. The sandy mantle is 20 to 36 inches thick. The Ap horizon is very dark grayish brown, dark grayish brown, or brown and is 6 to 9 inches thick. The B1 horizon is sand, fine sand, loamy sand, or loamy fine sand 14 to 30 inches thick. The IIB2t horizon is 6 to 10 inches thick. Gravel content ranges from 1 to about 7 percent. The IIIB3t horizon is light sandy loam or loamy sand 5 to 10 inches thick. The IIIC horizon is sand or fine sand.

Richford soils are near Gotham and Oshtemo soils. They have more clay in part of the B horizon than Gotham soils. They contain more sand than Oshtemo soils.



able water capacity that limits crop yields during most seasons. Planting early in spring, before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

This soil is suited to irrigation. Most of the acreage is used for general farm crops. Some has been planted to pine trees. With fertilization, supplemental irrigation, and protection from soil blowing, this soil can be used for farm crops and certain vegetable crops. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 2; wildlife group 3; tree and shrub group 2.

RaC—Richford loamy sand, 6 to 15 percent slopes. This soil is sloping and moderately steep and is on outwash plains and terraces and in areas of sandy eolian deposits on till uplands. Areas are elongated to irregular in shape and cover 3 to 30 acres.

This soil has a surface layer which is lighter colored and about 2 inches thinner than that of the soil described as representative of the series, and the surface layer and subsoil combined are about 6 inches thinner.

Included with this soil in mapping are small areas

limited by dolomite, but some roots extend into crevices which are filled with subsoil material. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

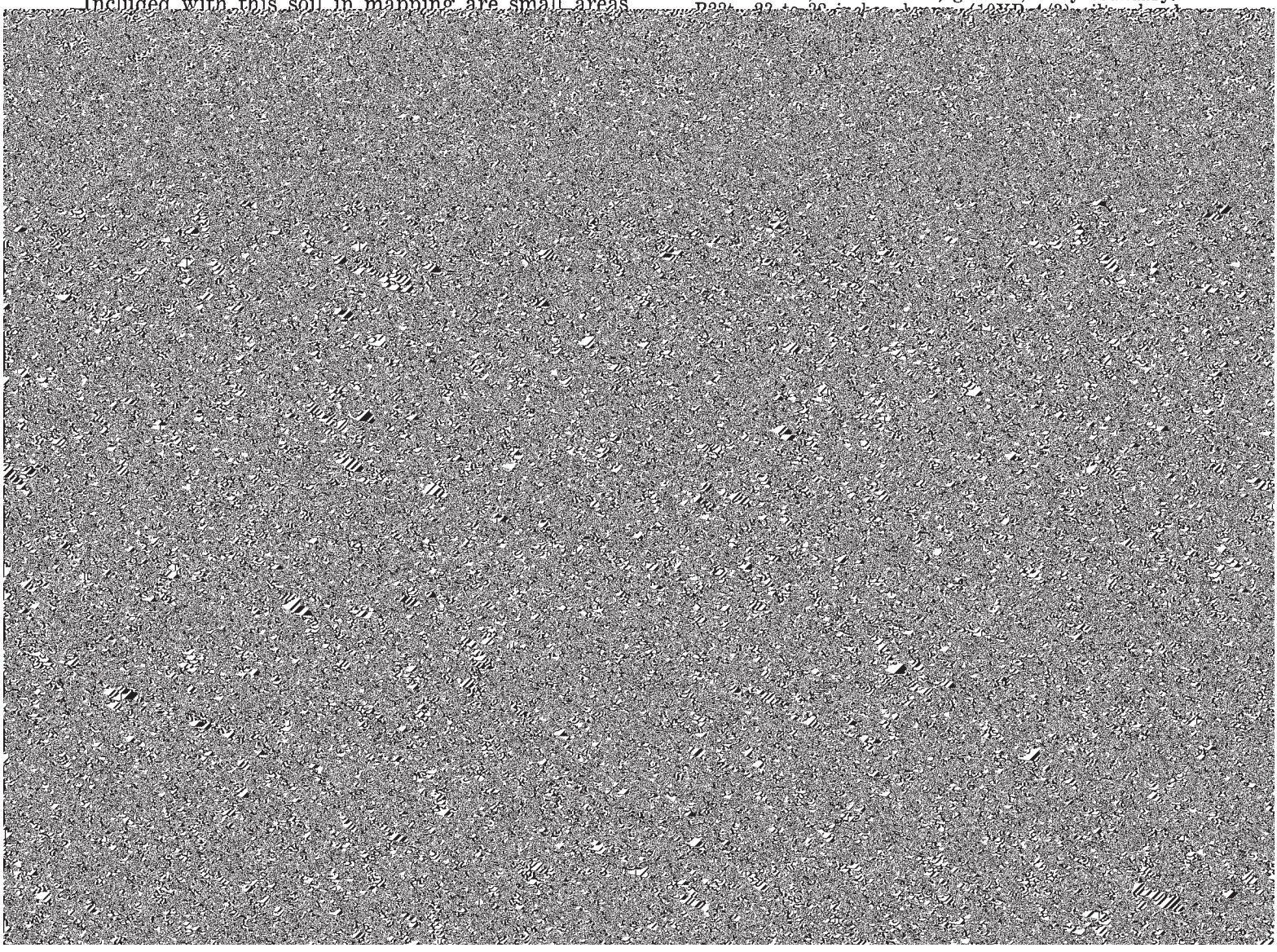
Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Ripon silt loam, 1 to 6 percent slopes, approximately 600 feet north and 1,050 feet east of the center of sec. 30, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 9 inches, black (10YR 2/1) silt loam, weak, fine and very fine, granular structure; very friable; few roots; few pores; mildly alkaline; abrupt, smooth boundary.

A12—9 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and very fine, granular structure; very friable; few roots; few pores; many very dark gray (10YR 3/1) and few yellowish-brown (10YR 5/4) earthworm casts; neutral; clear, smooth boundary.

B21t—11 to 23 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, subangular blocky structure; friable; few roots; common pores; thin patchy clay films on faces of some peds and in pores and channels; medium acid; gradual, wavy boundary.



and controlling erosion. Capability unit IIe–2; woodland group not assigned; recreation group 4; wildlife group 5; tree and shrub group 1.

Ritchey Series

The Ritchey series consists of gently sloping to very

soils by very gravelly sandy loam till in which the coarse fragments are mostly angular dolomite. Ritchey soils are shallower to dolomite than Knowles and Ripon soils and have a thinner or lighter-colored A horizon than Ripon soils.

RhB2—Ritchey silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping and is on broad ridgetops and upper side slopes in areas where dolomite

woodland group 3d1; recreation group 5; wildlife group 4; tree and shrub group 2.

to woodland. Where properly managed this soil can be used for pasture. The main concerns of management

Included in mapping are small areas of Knowles, LeRoy, Lomira, and Markesan soils. Also included are bedrock outcrops that have vertical or nearly vertical slopes.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very severe.

This unit is not suitable for cultivation because of rock fragments and bedrock outcrops. It is better suited to recreation or wildlife habitat. Most areas are in woodland, but some are in native grasses. Some of the acreage is pastured, but yields are low. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIIIs–10; woodland group 6s1; recreation group 5; wildlife group 10; tree and shrub group not assigned.

land, or wildlife habitat. Many areas that were once cultivated are now used for pasture or are idle. There are gravel pits in many areas, and the underlying deposits are a good source of sand and gravel.

Representative profile of Rodman gravelly sandy loam, 6 to 20 percent slopes, 1,225 feet south and 37 feet east of the northwest corner of the SW¼, sec. 16, T. 14 N., R. 12 E., in a cultivated field:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam; weak, fine, granular structure; very friable; many roots; common pores; about 15 percent gravel, by volume; mildly alkaline; abrupt, smooth boundary.

B2—5 to 11 inches, brown (7.5YR 4/4) gravelly sandy loam; weak, medium, subangular blocky structure; very friable; common roots; common pores; clay bridging between sand grains; about 45 percent gravel, by volume; mildly alkaline; abrupt, smooth

lying outwash deposits are sandy and lack appreciable gravel content.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is best suited to woodland or wildlife habitat, and it is used for those purposes. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIIs–5; woodland group 4f2; recreation group 2; wildlife group 4; tree and shrub group 2.

Rotamer Series

The Rotamer series consists of gently sloping to steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was a mixed hardwood forest with prairie grasses growing in the more open stands.

In a representative profile the surface layer is very dark grayish-brown sandy loam about 7 inches thick (fig. 11). The subsoil is about 12 inches thick. It is brown, friable loam in the upper part; brown, firm clay loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is brown, very friable gravelly sandy loam to a depth of 60 inches.

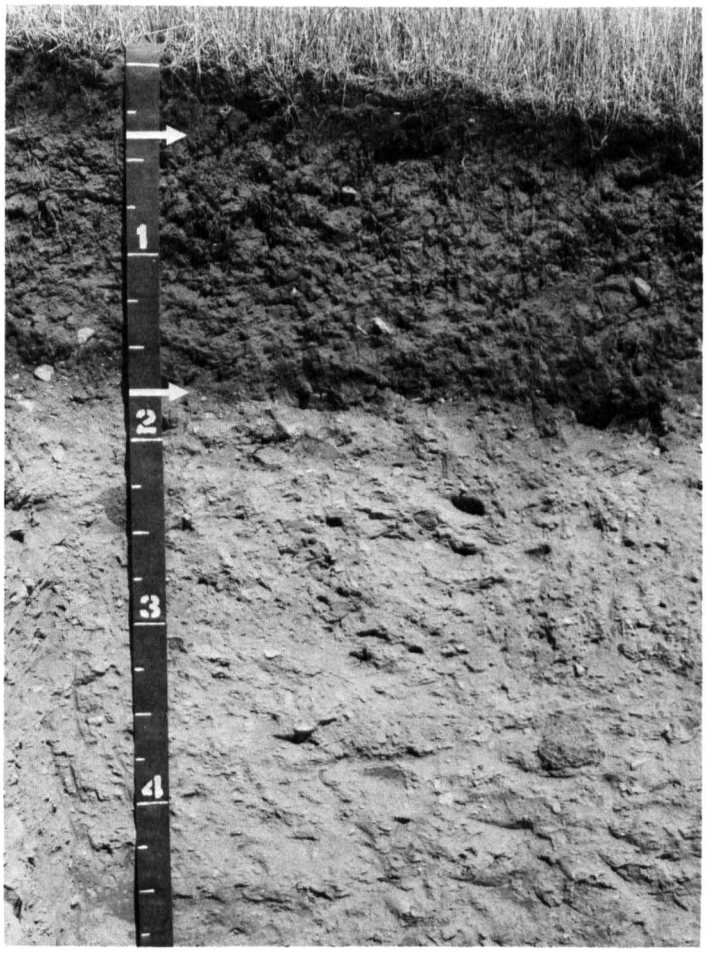


Figure 11.—**Profile of Rotamer soil underlain by gravelly sandy loam glacial till at a depth of about 21 inches.**

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderate.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep and steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Rotamer sandy loam, 6 to 12 percent slopes, eroded, approximately 20 feet east and 400 feet north of the southwest corner of sec. 26, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, medium, subangular blocky structure; very friable; common roots; common pores; some brown (7.5YR 4/4) subsoil in worm channels and mixed with matrix by plowing; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 9 inches, brown (7.5YR 4/4) loam; moderate, very fine, subangular blocky structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; thin, patchy clay films on faces of peds and in pores and channels; mildly alkaline; clear, smooth boundary.

B22t—9 to 17 inches, brown (7.5YR 4/4) light clay loam; moderate, very fine, subangular blocky structure; firm; common roots; common pores; thin patchy clay films on faces of peds and in pores and channels; mildly alkaline; clear, wavy boundary.

B3t—17 to 19 inches, brown (7.5YR 4/4) sandy loam; weak, medium, subangular blocky structure; friable; common roots; common pores; clay bridging between sand grains; neutral; clear, smooth boundary.

C—19 to 60 inches, brown (10YR 5/3) gravelly sandy loam; massive; very friable; few roots; common pores; about 30 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 20 percent.

The solum is 12 to 24 inches thick and overlies calcareous, gravelly sandy loam till. The A horizon is very dark grayish brown, dark brown, or very dark brown and is 6 to 9 inches thick. The B2t horizon is heavy loam, clay loam, or sandy clay loam 6 to 15 inches thick. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 35 percent, by volume.

Rotamer soils are near Grellton, Griswold, and Kidder soils. Rotamer soils have a thinner solum than the others. They lack the silt loam layer that occurs in the B horizon of Grellton soils.

RtB2—Rotamer sandy loam, 2 to 6 percent slopes, eroded. This soil is gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 160 acres.

Included with this soil in mapping are small areas of Lapeer and Okee soils and small areas of sloping and uneroded or severely eroded Rotamer sandy loam. In some small areas slopes are less than 2 percent; the surface layer is silt loam, loam, or loamy fine sand; or gravel or cobbles and boulders are on the surface and throughout the surface layer and subsoil. In other places, the substratum is stratified sand and gravel or dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight. In some places tillage is hampered by cobbles and boulders.

With proper management, this soil is suitable for

all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

drainageways of the till plains. Most areas are elongated and cover 3 to 20 acres.

This soil has a surface layer and subsoil which, combined, are about 2 to 3 inches thinner than in the soil described as representative of the series.

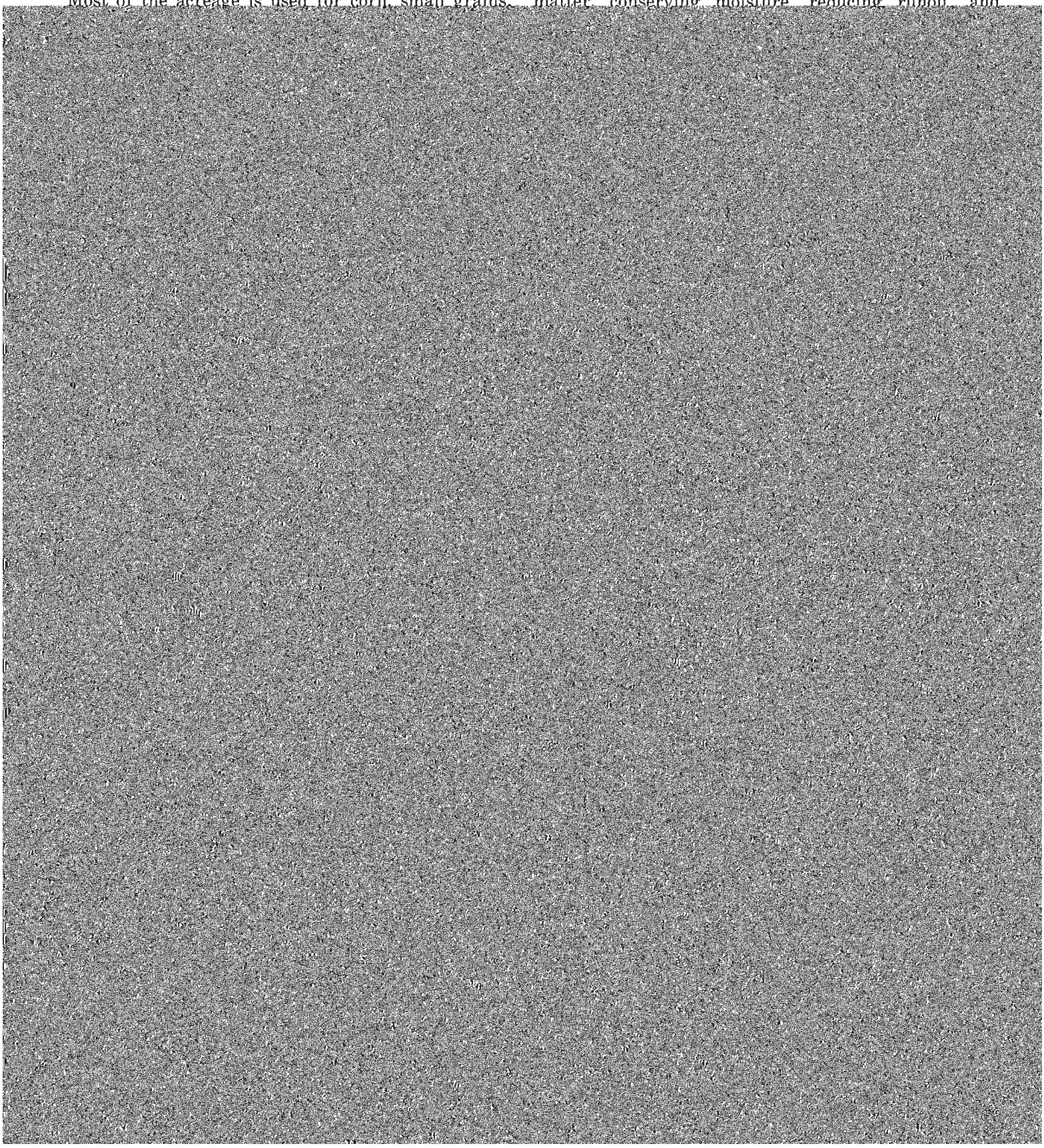
Included with this soil in mapping are small areas of Lapeer soils and small areas of moderately steep

faces of peds and in pores and channels; neutral;

Included with this soil in mapping are small areas

organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and

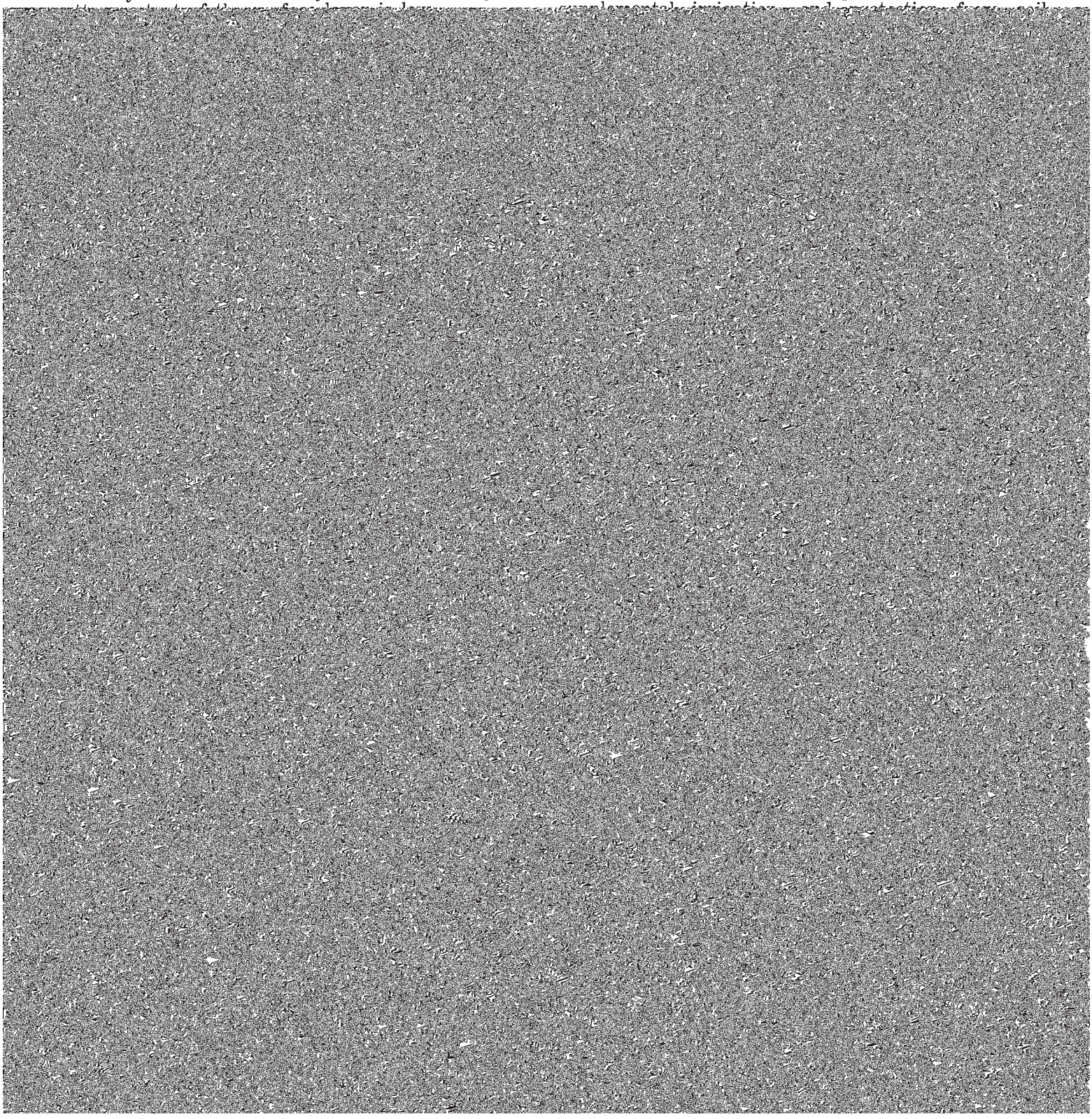


pale-brown, loose fine sand 26 inches thick. The subsoil is reddish-brown, firm clay 14 inches thick. The substratum is reddish-brown, firm silty clay to a depth of 60 inches.

The available water capacity is low. Permeability is rapid in the sandy upper layer and slow in the clayey lower layer. Natural fertility is low. The organic-

soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Planting early in spring, before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

This soil is suited to irrigation. Most of the acreage is used for general farm crops. With fertilization,



The solum is 20 to 40 inches thick and overlies sandstone bedrock. The Ap horizon is very dark grayish brown, dark grayish brown, or dark brown and is 6 to 9 inches thick. The B1 horizon is sandy loam or fine sandy loam 5 to 15 inches thick. The B2 horizon is sandy loam or fine sandy loam 8 to 20 inches thick.

These soils are more acid in the B horizon and more alkaline in the C horizon than is defined as the range for the series, but these differences do not alter their usefulness or behavior.

Urne soils are near Gotham sandstone substratum soils and have similar drainage to the Mecan soils. They have less sand and more clay in the solum than Gotham sandstone substratum soils. They have a thinner solum than Mecan soils. Urne soils are underlain by glauconitic sandstone bedrock, and Mecan soils by gravelly loamy sand till.

UrB—Urne loamy fine sand, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors in areas where the depth to sandstone is relatively shallow. Areas are irregular in shape and cover 3 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gotham and Mecan soils and small areas of sloping and eroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

Runoff is medium. The hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

Where properly managed, this soil is suitable for most of the farm crops commonly grown in the county. Most of the acreage is used for crops and pasture, but some is in woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 4; wildlife group 3; tree and shrub group 2.

UrC2—Urne loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes where the depth to sandstone is relatively shallow. Most areas are elongated and cover 3 to 25 acres.

This soil has a surface layer and subsoil which, combined, are about 3 to 5 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Gotham, Lapeer, and Mecan soils and small areas of gently sloping or moderately steep and uneroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

UrD2—Urne loamy fine sand, 12 to 20 percent slopes, eroded. This soil is moderately steep and steep and is on side slopes in areas where the depth to sandstone is relatively shallow. Most areas are elongated and cover 3 to 15 acres.

This soil has a surface layer 1 to 2 inches thinner than that of the soil described as representative of the series, and the surface layer and subsoil combined are 4 to 6 inches thinner.

Included with this soil in mapping are small areas of Gotham sandstone substratum, Lapeer, Oakville, and Okee soils, and small areas of sloping and uneroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

Runoff is rapid. The hazard of erosion is severe. The soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

This soil is best suited to pasture, woodland, or wildlife habitat. Some of the acreage is used for crops, and some is in woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–7; woodland group 3r1; recreation group 4; wildlife group 3; tree and shrub group 2.

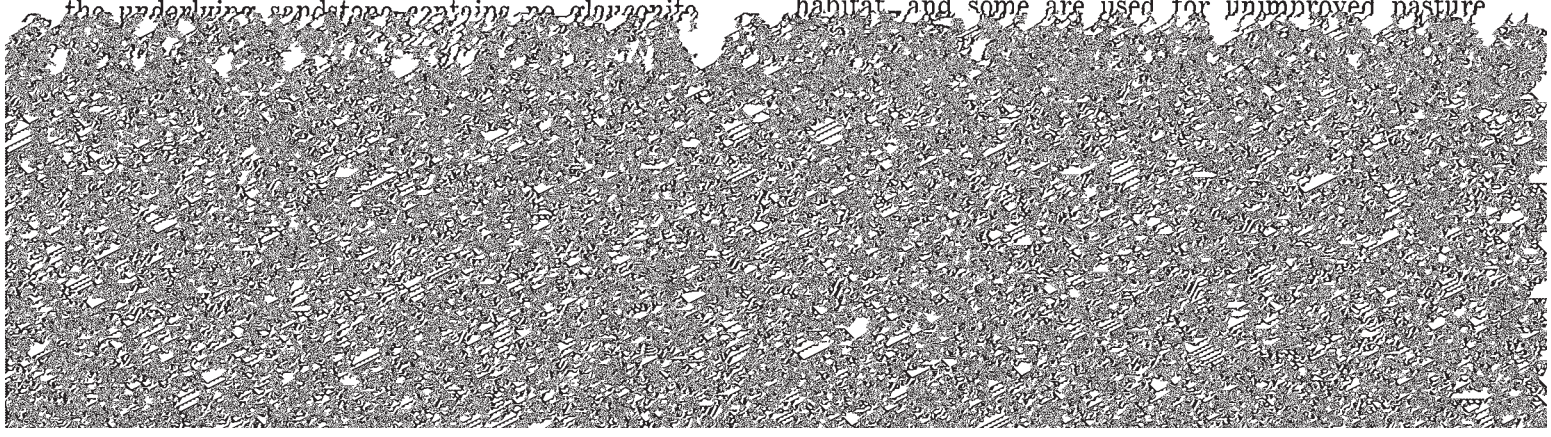
Willette Series

The Willette series consists of nearly level, very poorly drained soils on flood plains and in drainageways, depressions, and old glacial lake basins. These soils are organic and are underlain by clayey lacustrine deposits. The native vegetation was marsh plants such as sedges, reeds, and grasses; shrubs such as willow, alder, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black nonsticky muck about 30 inches thick. The substratum, to a depth of 36 inches, is mixed dark gray and very dark gray, firm silty clay. Below this, is reddish-gray, firm clay mottled with gray and light olive brown to a depth of 60 inches.

The available water capacity is very high. Permeability is rapid in the organic layers and slow in the substratum. The depth of root penetration is limited by the water table. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture



rubbed) sapric material; about 50 percent fiber, 5 percent rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; mildly alkaline; gradual, wavy boundary.

Oa4—23 to 30 inches, black (N 2/0 broken face and rubbed) sapric material; about 20 percent fiber, less than 5 percent rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; thin strata of dark gray (N 4/0) silty clay below a depth of 28 inches; mildly alkaline; gradual, smooth boundary.

IIC1g—30 to 36 inches, mixed dark-gray (5Y 4/1) and very dark gray (5Y 3/1) silty clay; massive; firm; few herbaceous fibers and woody fragments; mildly alkaline; diffuse, wavy boundary.

IIC2—36 to 60 inches, reddish-gray (5Y 5/2) clay; common, fine, distinct, gray (N 5/0) mottles and few, fine, prominent, light olive-brown (2.5Y 5/4) mottles; massive; firm; a few plant fibers in the upper part; violent effervescence; moderately alkaline.

The organic layer is 16 to 50 inches thick. The organic part of the subsurface and bottom tiers is mainly sapric material. In some places, however, thin layers of hemic material or fibric material are in the lower part of the organic layer. The organic material is mainly derived from herbaceous plants, but a few woody fragments ⅛ inch to several inches in diameter are in the lower part of the organic layer in some places. The IIC horizon is clay or silty clay.

Willette soils are near Poy and Poygan soils. They are underlain by clayey lacustrine deposits, and Poy soils are underlain by sand. They have a 16- to 50-inch organic layer which Poy and Poygan soils lack.

We—Willette muck. This soil is nearly level and is on flood plains and in drainageways, depressions, and old glacial lake basins. Most areas are irregular in shape and 3 to 200 acres in size, but one covers more than 1,100 acres.

Included with this soil in mapping are small areas of Granby clayey subsoil variant, Houghton, Palms, Poy, and Poygan soils. Also included are small areas that have as much as 16 inches of recent loamy overwash.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Surface Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is black silty clay loam about 8 inches thick. The subsoil is about 22 inches thick and has dark reddish-gray, light brownish-gray, and olive-gray mottles. It is reddish-brown, firm clay in the upper part and reddish-brown, firm clay loam in the lower part. The substratum is reddish-brown, very friable loamy fine sand in the upper part and light yellowish-brown, very friable fine sand to a depth of 60 inches. The substratum has light brownish-gray, reddish-brown, and very pale brown mottles.

The available water capacity is moderate. Permeability is slow in the subsoil and rapid in the substratum. The depth of root penetration is limited by saturated soil during wet periods of the growing season. Natural fertility is medium. The organic-matter content of the surface layer is moderate.

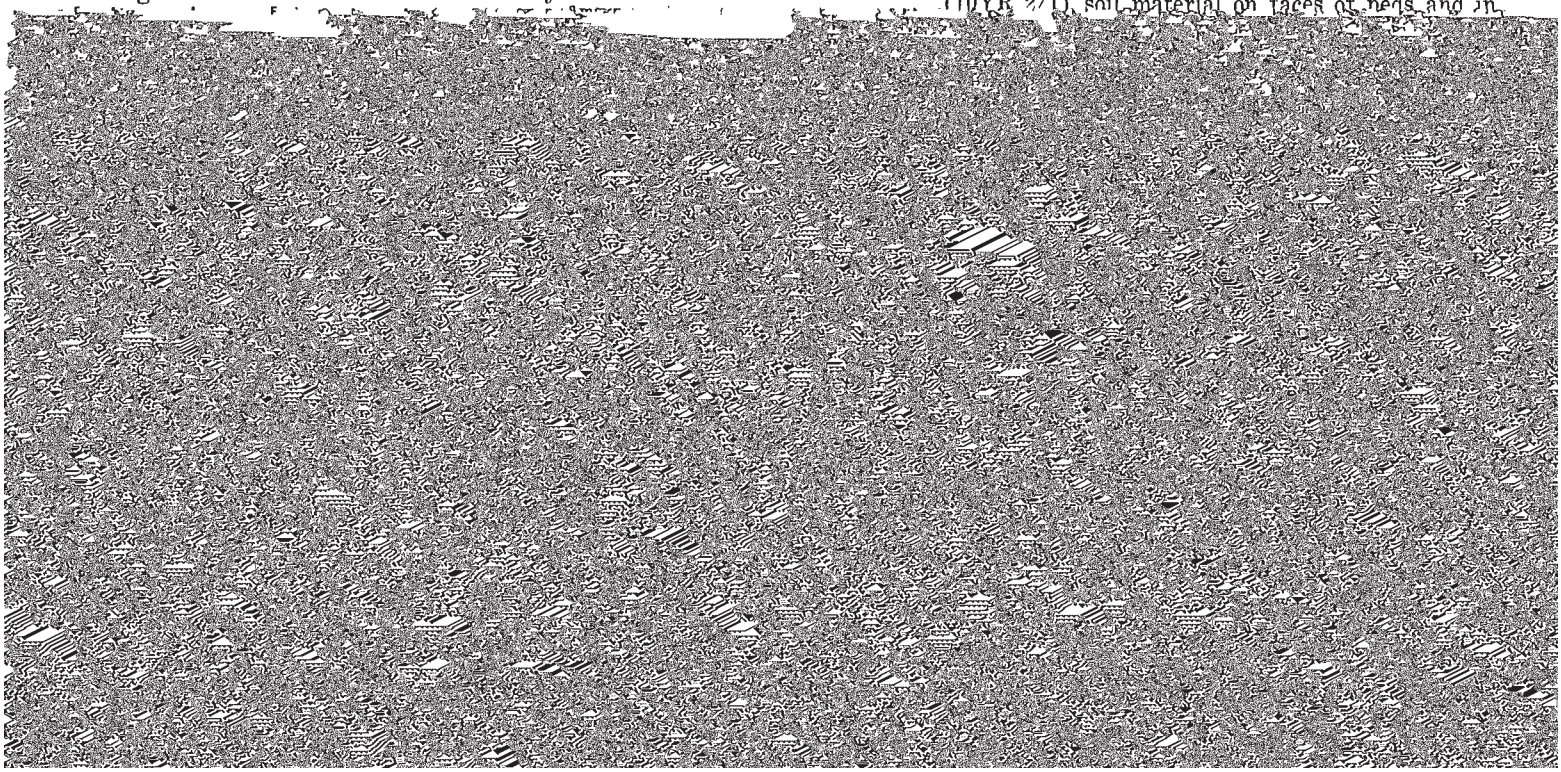
Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wildlife habitat, and some are used for unimproved pasture.

Representative profile of Zittau silty clay loam, 0 to 3 percent slopes, approximately 35 feet south and 600 feet west of the center of sec. 10, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 6 inches, black (10YR 2/1) silty clay loam; weak, medium, subangular blocky structure; friable; few roots; common pores; medium acid; abrupt, smooth boundary.

A12—6 to 8 inches, black (10YR 2/1) silty clay loam; weak, fine and very fine, subangular blocky structure; firm; few roots; common pores; some reddish-brown (5YR 4/3) subsoil in worm casts; medium acid; abrupt, smooth boundary.

B21t—8 to 13 inches, reddish-brown (5YR 4/3) clay; moderate, fine and very fine, angular blocky structure; firm; few roots; few pores; some black (10YR 2/1) soil material on faces of peds and in



horizon is sandy clay loam, sandy clay, or clay loam 3 to 8 renovation of pastures. These practices should be

of this period. In contrast, soils that have a low available water capacity, between 3 and 6 inches, will support these crops for only 10 to 20 days without rain under similar conditions.

The available water capacity is very important in determining levels of fertilization and population of plants where no irrigation is planned. A high level of fertilization is generally not justified on soils that have very low or low available water capacity, because crop growth is limited by the available water capacity. The soils that have very low and low available water capacity are coarse textured or have a thin solum. Excessive amounts of nitrate fertilizer added to these soils may be quickly leached from the soil and contaminate surface or ground water.

Drainage can be improved in most of the wet soils if there are suitable outlets. Surface drains, tile drains, open-ditch drains, or a combination of these are used to provide drainage. Diversions can be used in some places to protect the soils from runoff from adjacent areas. Soils on flood plains need protection from flooding.

Barry, Joy, Marcellon, and Poygan soils are well suited to both surface and tile drainage. Granby, Marshan, and Poy soils generally are not suited to tile drainage but are well suited to surface and open-ditch drainage. Organic soils of the Adrian and Edwards series generally are not suited to tile drainage, but are well suited to open-ditch drainage. Both tile and open-ditch drainage can be used on the organic Houghton, Palms, and Willette soils.

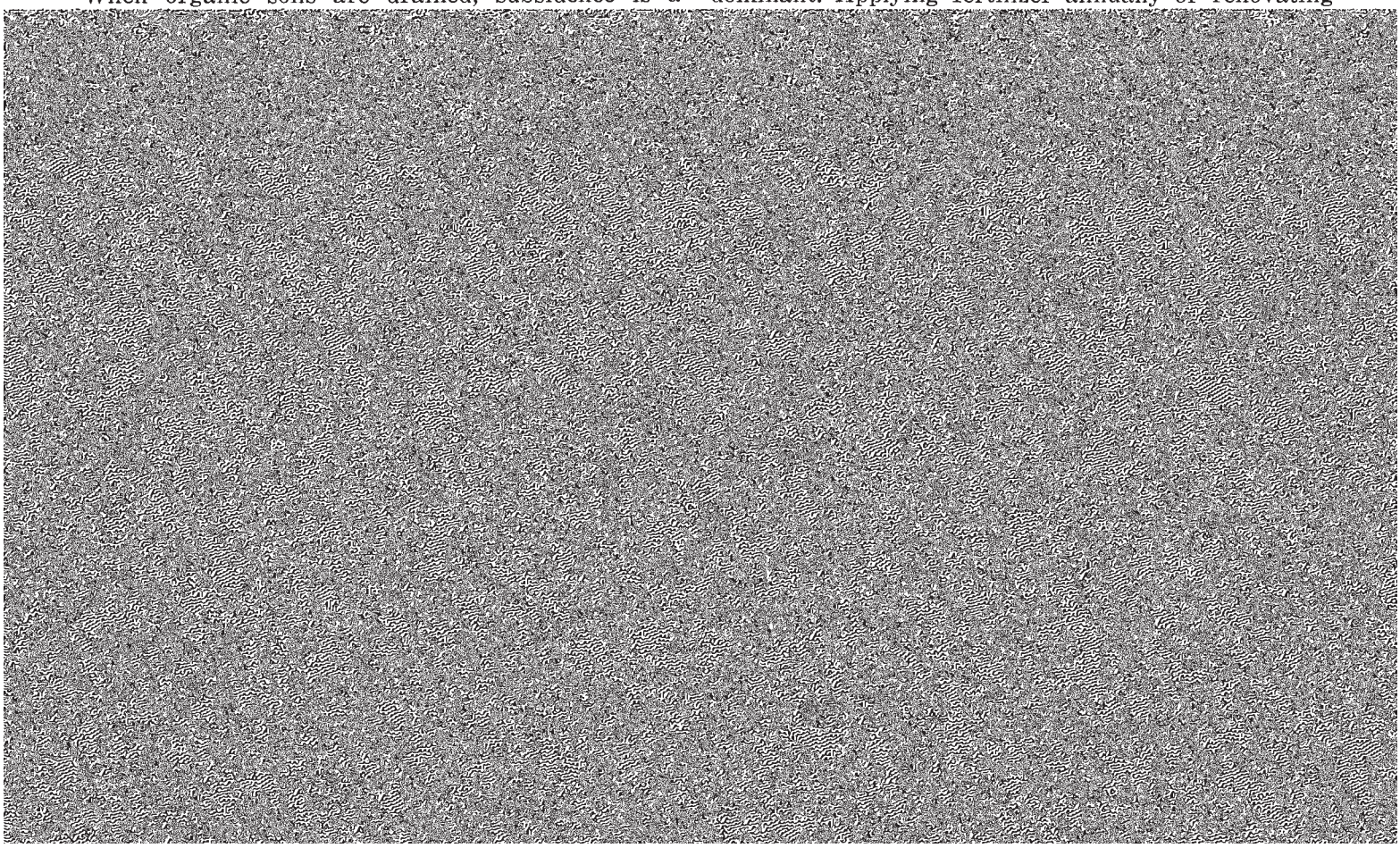
When organic soils are drained, subsidence is a

Minimum tillage is very effective in controlling water erosion. Where it is used in planting row crops, a minimum area of soil is disturbed. Special "no-till" planters knife open the seed bed, put in the seed and starter fertilizer, close the seed bed, and apply a herbicide–all in one operation. The proper kind and amount of herbicide is very important in minimum tillage. If the herbicide does not control the weeds, it must be done by cultivation, thus reducing the effectiveness of the original minimum tillage.

Most of the soils are subject to soil blowing. Soil blowing is evident in sandy Oakville, Gotham, and Richford soils. It is also evident in drained areas of organic soils and wet sandy Houghton and Granby soils. Practices that help to control soil blowing are stripcropping at right angles to the direction of prevailing winds, stubble mulching, leaving crop residue on the surface, growing cover crops or meadow crops, establishing shelterbelts, and controlling drainage in organic soils and wet sandy soils. Many of these practices also help to catch snow and add moisture to the soil.

Most upland pastures on well-drained soils of capability classes II, III, IV, and VI need renovating. A good seedbed should be prepared and a suitable mixture of grasses and legumes seeded. Suitable mixtures for seeding are alfalfa with bromegrass or birdsfoot trefoil with bromegrass.

Large amounts of phosphorus and potassium are needed at the time of seeding. Nitrogen should be applied as a topdressing, especially if grasses are dominant. Applying fertilizer annually or renovating



substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require mod-

units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Green Lake County are described and suggestions for use and management of the soils in each unit are given. The capability units are not numbered consecutively, because not all of the units used in Wisconsin are in this county. To find the names of all the soils in any given capability unit, refer to the "Guide to Manning Units" at the back of this survey.

Under proper management, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping and some nearly level, well-drained, loamy soils underlain by dolomite.

These soils are moderately permeable. The available water capacity is moderate, and natural fertility is medium or high.

The depth of root penetration is limited by dolomite. These soils are slightly susceptible to erosion. Some gently sloping soils that have been cropped have lost as much as 4 inches of the original surface layer through erosion.

Crop rotation, contour stripcropping, diversions, terraces, minimum tillage, and good management of crop residue help control erosion and maintain tilth. If these soils are not eroded, they are easily worked.

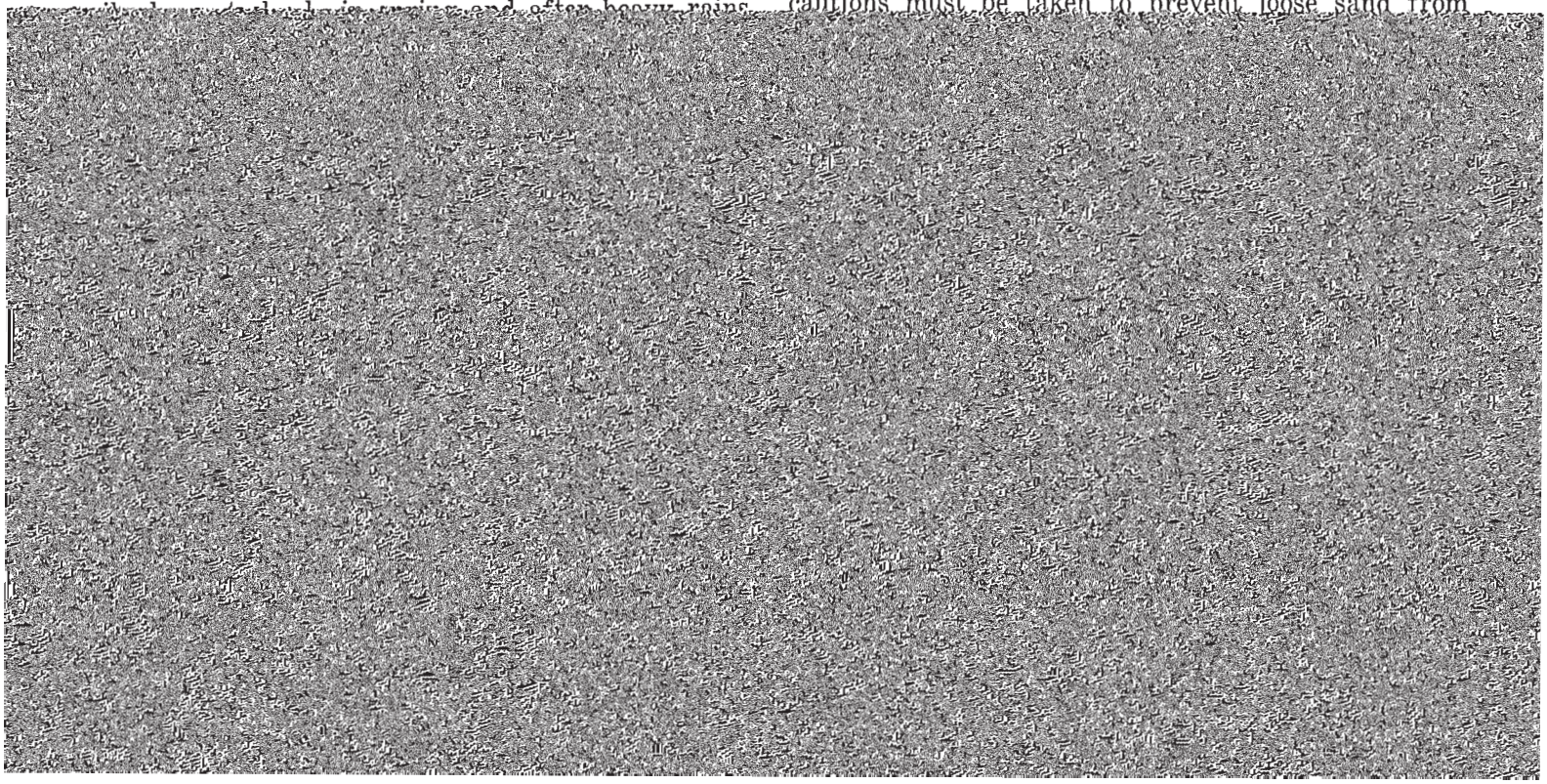
Under proper management, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture.

CAPABILITY UNIT IIe–6

This unit consists of nearly level and gently sloping, well drained and moderately well drained, loamy soils that have clayey subsoils underlain by silty clay loam, silty clay, or clay.

These soils are moderately slowly permeable. The available water capacity is moderate, and natural fertility is medium.

In some areas, these soils are saturated with water below a depth of 3 to 5 feet during wet periods. These soils are slightly susceptible to erosion. Some areas that have been cropped have lost as much as 4 inches of the original surface layer through erosion. These soils are saturated with water below a depth of 3 to 5 feet in wet periods and after heavy rains.



receive runoff from adjoining areas; some are subject to ponding and to flooding unless protected.

Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. If tile drains are installed in soils that are underlain by stratified silt loam, silt, and fine sand, precautions must be taken to prevent loose sand from entering and clogging the tile lines.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and certain vegetable crops. Response is good to heavy applications of fertilizer. These soils can support a large population of plants. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if soils are properly fertilized, and if minimum tillage is used to retain crop residue. Undrained soils are suited to pasture or wetland wildlife habitat.

CAPABILITY UNIT IIw–2

This unit consists of nearly level soils and some gently sloping soils that are somewhat poorly drained. These are loamy soils underlain by silt loam, silt, and very fine sand, gravelly sandy loam, or silty clay loam.

These soils are moderately permeable or slowly permeable. The available water capacity is high or very high, and natural fertility is high.

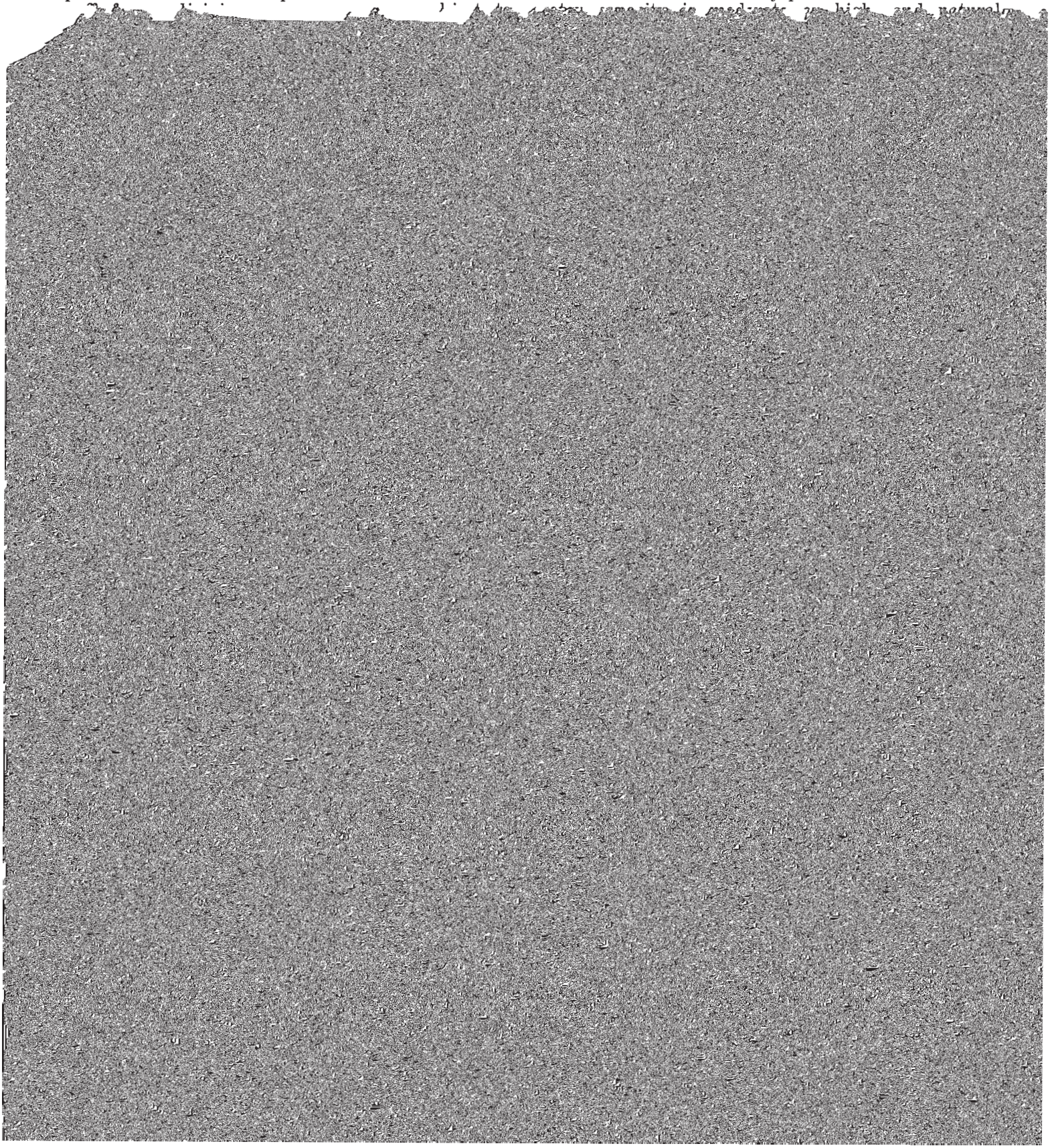
Unless the soils are drained, they are saturated with water below a depth of 1 to 3 feet in wet periods. They receive runoff from adjoining areas. Some areas are subject to ponding in wet periods and after heavy rain.

Tile drainage and deep ditches can be used to remove excess water if a suitable outlet is available. If tile drains are installed in soils that are underlain by stratified silt loam, silt, or very fine sand, precautions must be taken to prevent loose sand from

the surface in some soils throughout the year. Undrained soils are saturated with water below a depth of 1 to 3 feet in wet periods. These soils receive

gravelly sandy loam, very gravelly sandy loam, or stratified silt, silt loam, and very fine sand.

These soils are moderately permeable. The available



These soils are mostly moderately permeable or moderately rapidly permeable, but those that are underlain by silty clay are rapidly permeable in the upper part of the subsoil and slowly permeable in the lower part of the substratum. The available water capacity is moderate or low, and natural fertility is medium or low. These soils are slightly susceptible to erosion. In some areas that have been cultivated as much as 4 inches of

drains are installed, precautions must be taken to prevent loose sand from entering and clogging the tile lines. If tile is placed in a slowly permeable, clayey substratum, backfilling with porous material can help the tile to function. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained

from adjoining areas. Some areas are subject to ponding and flooding.

Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, this soil is subject to soil blowing, burning, and subsidence. If the water table is lowered excessively, subsidence is rapid.

If properly drained and protected from flooding and soil blowing, this soil is well suited to corn and certain vegetable crops. Response is good to applications of fertilizer. This soil can support a large population of plants. It can be used for row crops for many years if properly fertilized and if good management practices are used, but oxidation and subsidence will continue to thin the organic layer. Undrained areas can be used for pasture, but are more suitable for wetland wildlife habitat.

CAPABILITY UNIT IIIs–4

This unit consists of nearly level and gently sloping, well drained and somewhat excessively drained, sandy soils that have a loamy subsoil underlain by stratified sandstone bedrock.

These soils are moderately rapidly permeable or moderately permeable. The available water capacity is moderate or low, and natural fertility is medium or low. The soils are subject to soil blowing. The gently sloping soils are slightly susceptible to erosion.

Close-growing crops, stripcropping, windbreaks, minimum tillage, and good management of crop residue and cover crops help control erosion and soil blowing and maintain the available water supply and organic-matter content. The soils that have a low available water capacity have a limited suitability for crops, and heavy fertilization is not generally economical.

The soils are suited to row crops, small grains, hay, and pasture. They are suited to irrigation. If irrigated, they are suited to production of truck crops.

CAPABILITY UNIT IVe–1

This unit consists of moderately steep, well-drained, loamy soils underlain by gravelly sandy loam, very gravelly sandy loam, or stratified silt, silt loam, and very fine sand.

These soils are moderately permeable. The available water capacity is moderate or high, and natural fertility is medium or high. These soils are highly susceptible to erosion. Tillage is difficult because of

CAPABILITY UNIT IVe–2

The only soil in this unit is Knowles silt loam, 12 to 20 percent slopes, eroded. This is a moderately steep, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is moderate, and natural fertility is medium. The soil is highly susceptible to erosion. In some areas that have been cultivated up to 4 inches of the original surface layer has been lost through erosion. Tillage is difficult because of slope and because eroded areas have poor tilth.

Crop rotation, close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of crop residue help control erosion, increase infiltration, and maintain good tilth.

This soil is not well suited to row crops, but with proper management it is suited to small grains, legumes, and some corn or soybeans. It is suited to pasture.

CAPABILITY UNIT IVe–3

The only soil in this unit is Ritchey silt loam, 6 to 12 percent slopes, eroded. This is a sloping, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is low, and natural fertility is medium. The soil is moderately susceptible to erosion. In most areas that have been cultivated, as much as 4 inches of the original surface layer has been lost through erosion. The eroded areas have poor tilth, and tillage is further limited by dolomite fragments in some areas.

Crop rotation, close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of crop residue help control erosion and maintain good tilth. The low available water capacity limits suitability of the soil for crops, and heavy fertilization is not generally economical.

This soil is not well suited to row crops, but with proper management it is suited to small grains, hay, and some corn or soybeans. It is suited to pasture.

CAPABILITY UNIT IVe–4

This unit consists of sloping, well drained and somewhat excessively drained, sandy and loamy soils that have a loamy subsoil underlain by gravelly sandy loam or gravelly loamy sand.

These soils are moderately permeable or moderately rapidly permeable. The available water capacity is moderate, and natural fertility is medium. The soils are moderately susceptible to erosion. In many cultivated areas as much as 4 inches of the original surface layer has been lost through erosion.

steep, well drained and somewhat excessively drained, sandy soils that have a loamy subsoil underlain by stratified sand and gravel or by sandstone bedrock.

These soils are moderately rapidly permeable. The available water capacity is moderate or low, and natural fertility is low. The soils are subject to soil blowing. They are severely susceptible to erosion. In many areas that have been cultivated as much as 6 inches of the original surface layer has been lost through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, windbreaks, minimum tillage, and good management of residue help control erosion and soil blowing and maintain the available water capacity and organic-matter content. The soils that have a low available water capacity have a limited suitability

the surface throughout the year. The soils receive runoff from adjoining areas; some are subject to ponding and flooding.

Deep ditches and tile drainage can be used to lower the water table if a suitable outlet is available. If tile drainage is used in the soils underlain by sand, precautions must be taken to prevent loose sand from entering and clogging the tile lines. If tile is used in the soil underlain by marl, it should be placed in the more permeable organic material if possible. If the tile must be placed in the marl, backfilling with porous material will help the tile to function. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, these soils are subject to soil blowing, burning

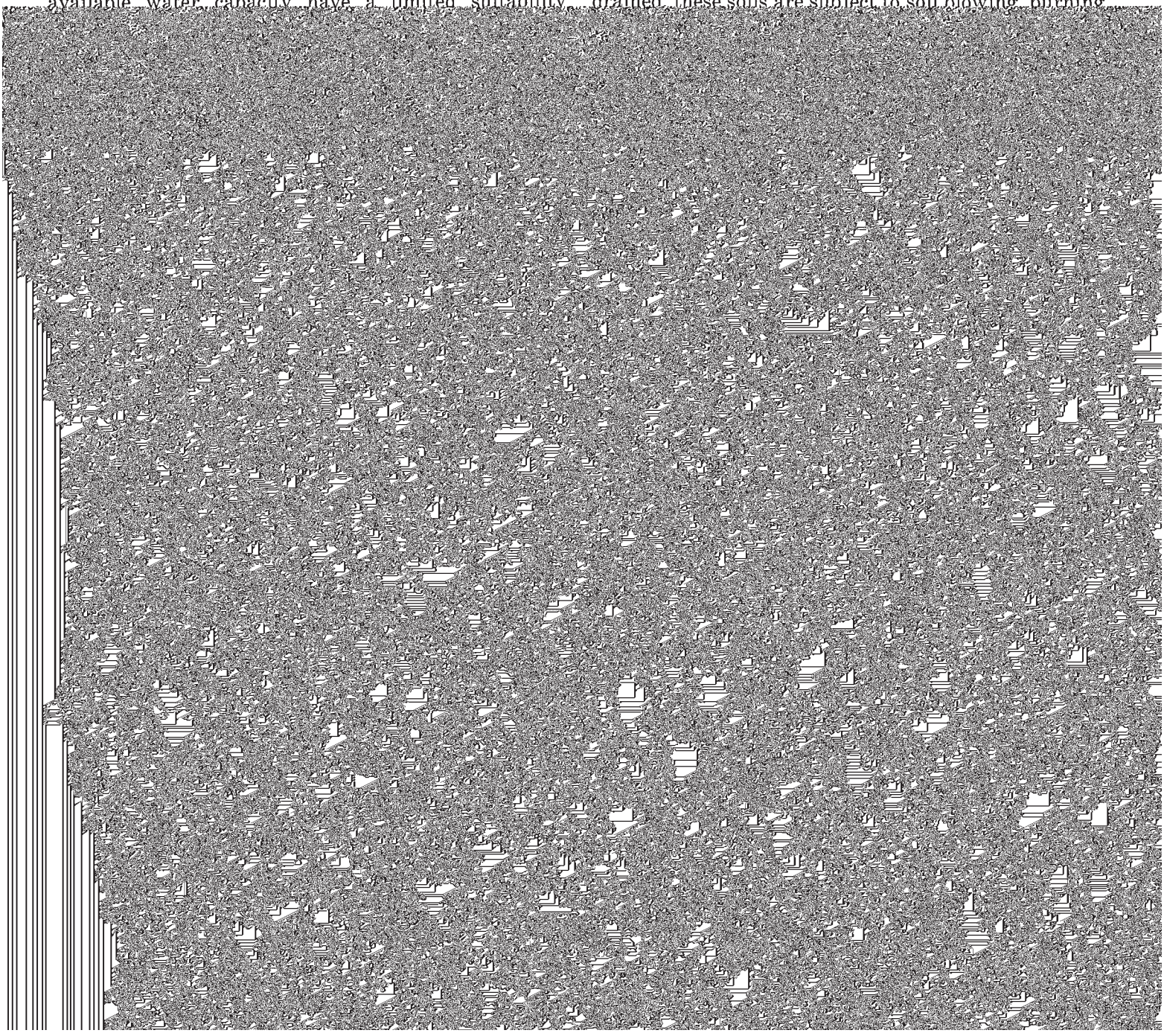


Figure 12.—**Windblown sand accumulates in fence rows and other protected areas when soil blowing occurs in an area of Gotham soils.**

meandering stream channels, oxbows, sloughs, and by frequent flooding.

The sediments are too variable to rate for permeability, natural fertility, and available water capacity. Unless they are drained, ground water is at or near the surface throughout the year. Drainage and protection from flooding are generally impractical.

Most areas are used for pasture, woodland, or wetland wildlife habitat.

CAPABILITY UNIT VIe–1

This unit consists of steep, well-drained, loamy soils underlain by gravelly sandy loam.

These soils are moderately permeable. The available water capacity is moderate, and natural fertility is medium. The soils are very highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the very severe erosion hazard, these soils are generally not suited to cultivated crops. With proper management they are suited to pasture and hay. They are used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–3

The only soil in this unit is Ritchey silt loam, 12 to 20 percent slopes, eroded. This moderately steep, well-drained, loamy soil is underlain by dolomite.

This soil is moderately permeable. The available water capacity is low, and natural fertility is medium. This soil is highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the severe erosion hazard, shallow root zone, and low available water capacity, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–4

The only soil in this unit is Lapeer loamy fine sand, 12 to 25 percent slopes, eroded. This is a moderately steep and steep, well-drained, loamy soil that is underlain by gravelly sandy loam.

This soil is moderately permeable. The available water capacity is moderate, and natural fertility is

medium. The soil is highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the severe erosion hazard, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–7

The only soil in this unit is Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes. This moderately steep, well drained and somewhat excessively drained, sandy soil has a sandy subsoil underlain by sandstone bedrock.

This soil is rapidly permeable. The available water capacity is low, and natural fertility is low. The soil is highly or very highly susceptible to erosion and is subject to soil blowing. Many areas of this soil are wooded or in pasture and have been eroded only slightly. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain plant cover and control erosion.

Because of low available water capacity and the severe erosion hazard, this soil is generally not suited to cultivated crops. Under proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland or wildlife habitat.

Because of very low available water capacity, erosion hazard, and gravelly surface layer, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland and wildlife habitat.

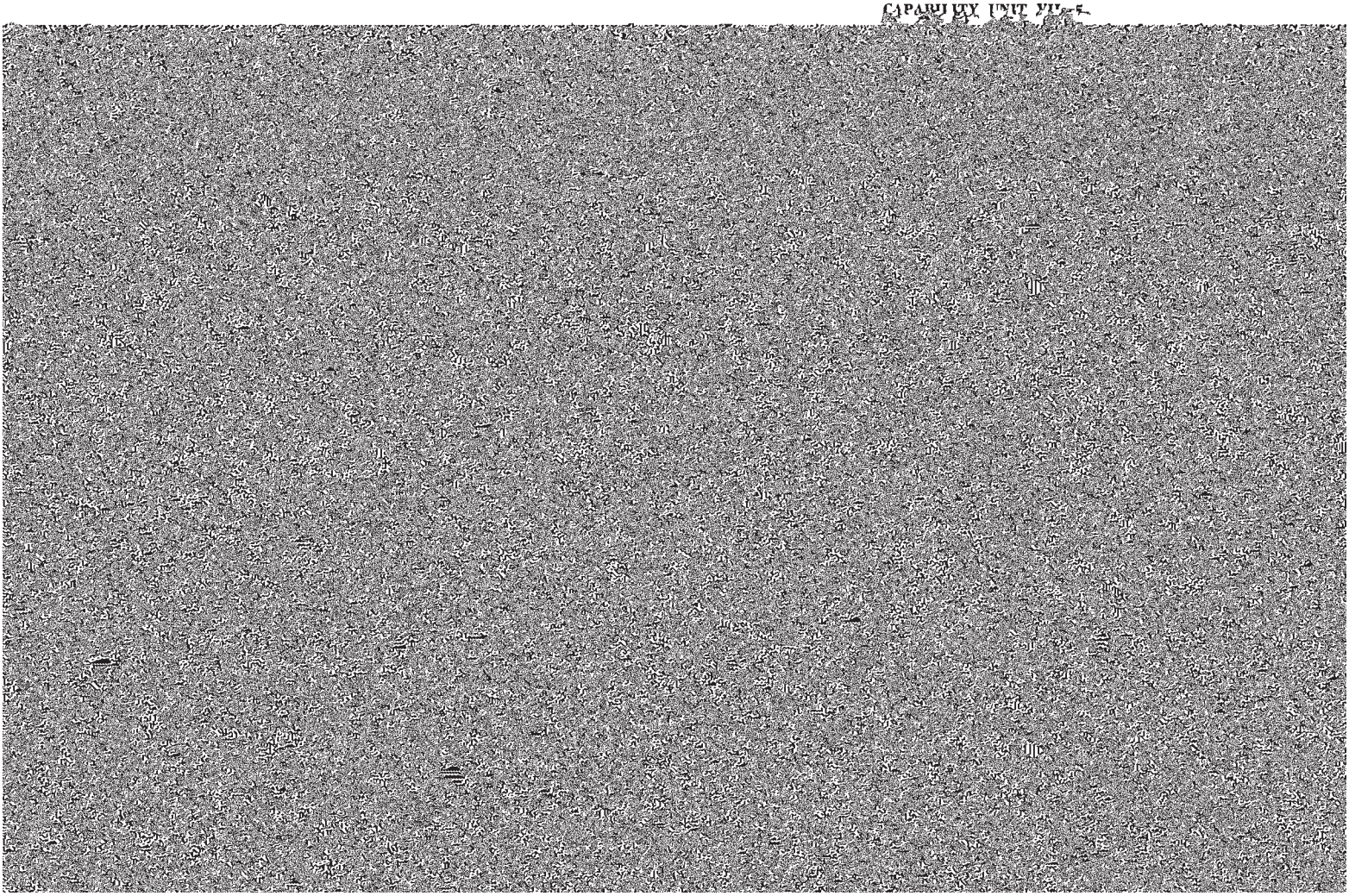
CAPABILITY UNIT VIIs–3

The only soil in this unit is Oakville fine sand, 12 to 35 percent slopes. This moderately steep to very steep, well-drained, sandy soil is underlain by sand.

This soil is rapidly permeable. The available water capacity is low, and natural fertility is low. The soil is highly and very highly susceptible to erosion and is very susceptible to soil blowing. Establishing plant cover is difficult. Controlled grazing and topdressing with fertilizer help maintain plant cover and control erosion and soil blowing. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in this sandy soil.

Because of low available water capacity, the severe and very severe hazard of erosion, and high susceptibility to soil blowing, this soil is not suited to cultivated crops. With proper management, it is suited to pasture, but yields are low. Improved pasture is difficult to establish and maintain. Many pasture areas are in native bluegrass. This soil is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIIs–5



CAPABILITY UNIT VIIIs–10

This unit consists of sloping to very steep soils and

long period of time and assume an average amount of rainfall.

TABLE 2.—*Predicted average yield per acre of principal crops*

[These yields are those obtained under an improved or high level of management. Absence of a yield figure indicates that the soil is not suited to the crop, or that the crop is not ordinarily grown on the soil]

Soil	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)	Sweet corn	Early June peas	Sweet peas
	Grain	Silage					
	Bu	*Tons*	*Bu*	*Tons*	*Tons*	*Lbs*	*Lbs*
Adrian muck [3]	90	15			3.7		
Alluvial land, wet [4]							
Barry loam [3]	115	19	65	4.0	4.2		
Boyer loamy fine sand, 1 to 6 percent slopes	70	11	50	2.5	2.9	1,500	1,800
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	65	11	50	2.0	2.7	1,410	1,690
Boyer loamy fine sand, 12 to 25 percent slopes	55	9	45	2.0	2.3	1,200	1,440
Brems loamy fine sand, 0 to 6 percent slopes	60	10	40	2.3	2.2		
Briggsville silt loam, 0 to 2 percent slopes	100	17	70	4.5	4.0	1,600	2,130
Briggsville silt loam, 2 to 6 percent slopes	90	17	70	4.0	4.0	1,700	2,250
Colwood silt loam [3]	95	16	60	4.0	4.0		
Dodge silt loam, 2 to 6 percent slopes	115	17	75	4.5	4.2	1,700	2,250
Dodge silt loam, 6 to 12 percent slopes, eroded	100	16	60	4.0	4.0	1,600	2,100
Edwards muck [3]	80	13			3.5		
Friesland loam, 0 to 2 percent slopes	110	18	75	4.5	4.5	2,350	2,850
Friesland loam, 2 to 6 percent slopes	110	18	75	4.0	4.5	2,500	3,000
Gotham loamy fine sand, 1 to 6 percent slopes	60	10	50	2.5	2.0		
Gotham loamy fine sand, 6 to 12 percent slopes	60	10	50	2.2	1.9		
Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	60	10	50	2.2	1.9		
Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes				1.5			
Granby loamy fine sand [3]	70	12	55	3.3	2.5		
Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes [3]	80	13	60	3.5	2.5		
Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes [3]	80	13	60	3.5	2.5		
Grellton fine sandy loam, 0 to 2 percent slopes	105	18	70	4.0	4.5	2,350	2,850
Grellton fine sandy loam, 2 to 6 percent slopes	105	18	70	4.0	4.5	2,500	3,000

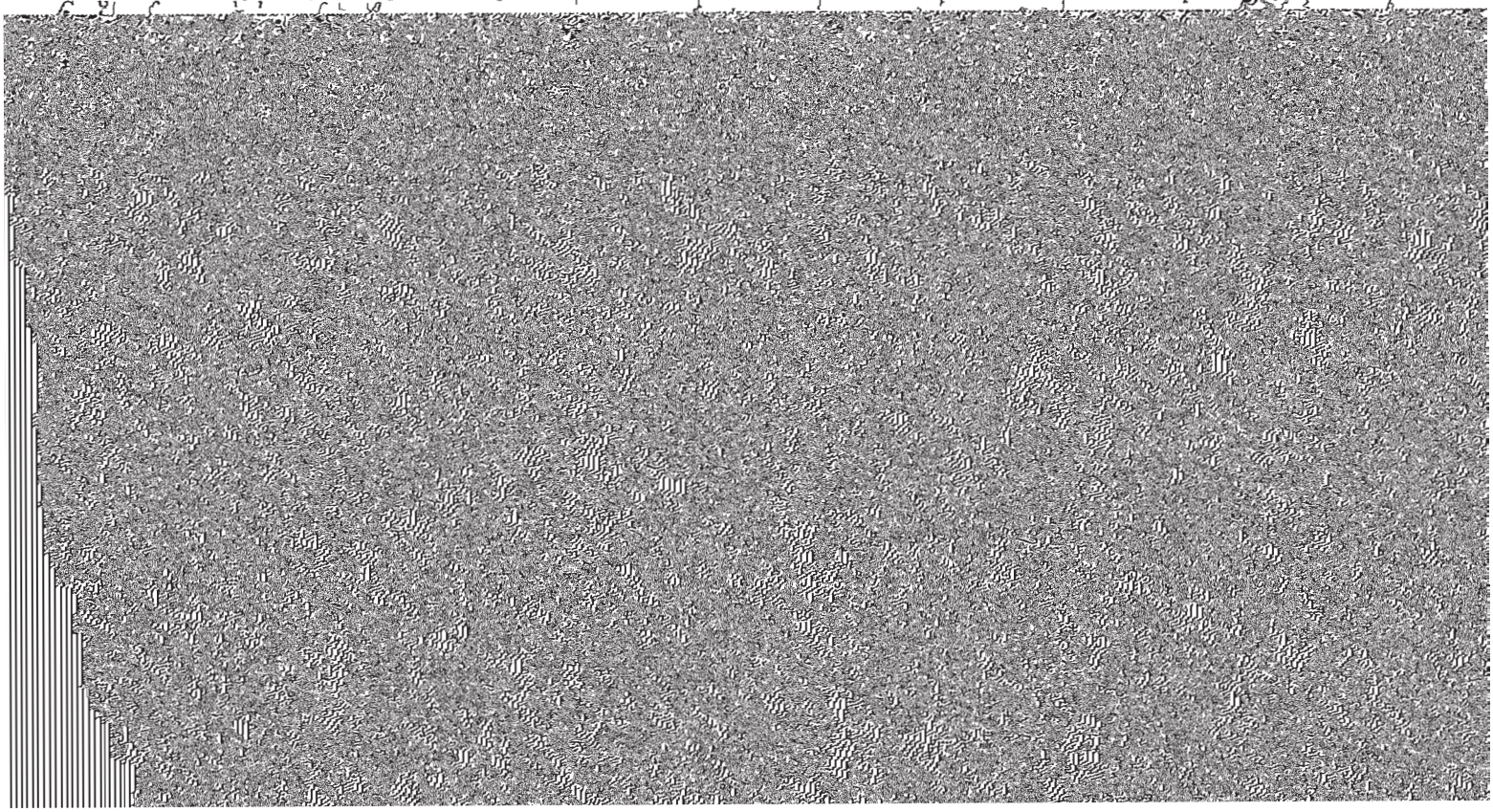


TABLE 2.—*Predicted average yield per acre of principal crops*—Continued

Soil	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)	Sweet corn	Early June peas	Sweet peas
	Grain	Silage					
	Bu	*Tons*	*Bu*	*Tons*	*Tons*	*Lbs*	*Lbs*
Lomira silt loam, 12 to 20 percent slopes, eroded	70	11	50	3.0	3.2	2,300	2,750
Manawa silt loam, 0 to 3 percent slopes [3]	90	15	70	4.5	3.8		
Marcellon loam, 0 to 3 percent slopes [3]	115	19	75	4.5	4.3		
Markesan silt loam, 2 to 6 percent slopes, eroded	85	14	60	3.0	3.3	1,700	2,250
Markesan silt loam, 6 to 12 percent slopes, eroded	80	13	55	3.0	3.0	1,590	2,115
Markesan silt loam, 12 to 20 percent slopes, eroded	70	11	50	2.5	2.9	1,360	1,800
Marsh [4]							
Marshan silt loam [3]	100	17	65	3.5	4.0		
Mecan loamy fine sand, 2 to 6 percent slopes	75	12	60	3.0	3.5	1.600	1,900
Mecan loamy fine sand, 6 to 12 percent slopes, eroded	70	11	55	3.0	3.3	1,500	1,780
Mendota silt loam, 0 to 2 percent slopes	120	20	80	5.0	4.3	2,350	2,850
Mendota silt loam, 2 to 6 percent slopes	110	19	80	5.0	4.2	2,500	3,000
Mendota silt loam, 6 to 12 percent slopes, eroded	100	18	70	4.5	3.9	2,300	2,750
Oakville fine sand, 1 to 6 percent slopes	55	9	45	2.5	1.9		
Oakville fine sand, 6 to 12 percent slopes				2.0			
Oakville fine sand, 12 to 35 percent slopes							
Okee loamy fine sand, 1 to 6 percent slopes	75	12	60	3.5	3.0	1,400	1,700
Okee loamy fine sand, 6 to 15 percent slopes	70	11	50	3.0	3.0	1,300	1,600
Oshtemo loamy fine sand, 1 to 6 percent slopes	70	11	50	2.3	2.9	1,500	1,800
Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	60	10	45	2.0	2.7	1,410	1,690

erosion control practices are installed and maintained. Cropping systems are suitable for the soil and slope. Annual and perennial weeds are controlled by timely use of mechanical and chemical methods. Insects that damage crops are controlled.

Peas and sweet corn are commonly grown in Green Lake County and are processed at several canning factories in the area. Yields given for these crops in table 2 are the average yields obtained over a period of approximately 15 years without irrigation. These yields include the extra-early and extra-late season plantings made to increase canning factory efficiency and are not the highest yields possible. Because peas are very sensitive to soil wetness, the yields on nearly level soils are slightly less than on gently sloping soils. Peas and sweet corn are not generally grown on soils that have more than 15 percent slope. Yields listed for moderately steep soils are for 12 to 15 percent slopes.

Woodland [2]

Before settlement, most of Green Lake County was covered by a stand of open-grown timber. Intermingled with the trees were prairie grasses: big bluestem, little bluestem, indiangrass, and switchgrass. In most of the timbered area the dominant tree was oak. Other hardwoods grew in some areas, and jack pine grew in open stands in some areas of sandy soils.

A fairly extensive area in the southeastern corner of the county was a nearly treeless tall-grass prairie in which big and little bluegrass, indiangrass, and switchgrass were dominant. Some low-lying wet areas consisted of lowland hardwood timber and occasional open areas of sedge-bluejoint grass-cordgrass marsh vegetation (*5*).

With the coming of farming, most of the open prairie was plowed for crops. The control of fires favored growth of hardwood trees other than oak. Most other woodlands are small scattered tracts, which are not managed for timber production (fig. 14).

In a 1968 inventory of the forest resources, 27,700 acres was in commercial forest, about 12 percent of the land area (*25*). Almost all of this is small, privately owned tracts, mostly farm woodlots. The forest is 40 percent oak and hickory; 25 percent maple, beech, and birch; 15 percent elm, ash, and cottonwood; 9 percent aspen and birch; 6 percent conifers; and the rest is not stocked.

Much of the land once farmed has been planted to red pine, white pine, and jack pine. These plantings help conserve soil and water as well as provide wildlife habitat and add to the esthetic value of the land. The plantings have been especially important on sandy soils such as Brems, Boyer, Gotham, Oakville, Okee, and Oshtemo soils.

The soils of Green Lake County have been placed in 26 woodland suitability groups to assist owners in planning the use of their soils for wood crops. In table 3, the soils of each woodland suitability group are rated for woodland use and management.

The first column in table 3 gives the woodland suitability groups in the county and the soils in each group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity. Each woodland suitability group is identified by a three-part symbol, such as "2o1" or "3r1."

Figure 14.—**Mixed hardwood trees in an area of Lomira soils. This woodlot is protected from burning and cattle grazing.**

The first part of the symbol indicates the relative productivity of the soils: 1 is high, 2 is moderately high, 3 is moderate, 4 is moderately low, 5 is low, and 6 is not productive.

The second part of the symbol, a letter, indicates the subclass and an imporatant soil property that imposes a slight to severe limitation in managing the soils for wood production. Definitions of the subclasses follow:

Subclass w (excessive wetness). Soils in which excessive water, either seasonally or yearlong, causes significant limitations for woodland use or management. These soils have restricted drainage, high water tables, or are subject to flooding, which adversely affect either stand development or management.

Subclass d (restricted rooting depth). Soils that are restricted or limited for woodland use or management because root penetration is restricted. Soils shallow to hard rock, hardpan, or

[2] By GEORGE W. ALLEY, forester, Soil Conservation Service, at Madison.

TABLE 3.—*Woodland*

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				

TABLE 3.—*Woodland*—Continued

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				
				Bd ft				
Group 3d2: RhD2	Red oak	55	(2)	160	Red pine, eastern white pine, and jack pine.	Moderate	Severe	Slight on north- and east-facing slopes; moderate on south- and west-facing slopes.
	Black oak	55	(2)	160				
Group 3c2: ZtA	Red oak	55	(2)	160	Eastern white pine, white spruce, and red pine.	Slight	Slight	Slight.
	Red maple	55	(2)	----------				
	White ash	55	(2)	----------				
Group 3s1: BrB, GaB, GaC, GbC, OaB, OaC.	Red oak [3]	57	2	180	Red pine, jack pine, and eastern white pine.	Slight	Slight	Moderate.
	White oak	47	1	115				
	White pine	52	2	230				
	Red pine	43	1	160				
	Jack pine	50	1	60				
Group 3s3: GbD, OaD.	Red oak [3]	57	(2)	180	Red pine, jack pine, and eastern white pine.	Severe	Severe	Moderate.
	White oak	47	(2)	115				
	White pine	52	(2)	230				
	Red pine	43	(2)	160				
	Jack pine	50	(2)	60				
Group 3o1: BpB, BpC2, LaB, LaC2, Lb, MnB, MnC2, OmB, OmC2, RaB, RaC,	Red oak [3]	59 ± 7.7	7	185	Eastern white pine, red pine, and white spruce.	Slight	Slight	Slight.
	White pine	61	1	400				
	Red pine	55	1	300				
	White oak	52	1	140				

TABLE 3.—*Woodland*—Continued

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				
				Bd ft				
Group 3w3: Ad, Ed, Ho, Pa, We.	Tamarack	48	4	95	Unsuitable for planting.	Severe	Slight	Slight.
	Northern white-cedar.	35	1	50				
	Red maple	65	1	120				
	Silver maple	92	2	240				
	Tree growth on these soils is usually limited to tamarack, northern white-cedar, willows, or elm. Occasionally silver maple, red maple, white ash or green ash become established and make rapid growth.							
Group 4w2: An, Bb, Mh.	Silver maple	70	[2]	140	White spruce, red maple, silver maple, white ash, and green ash.	Severe	Slight	Moderate to severe.
	Red maple	50	[2]	50				
	White ash	50	[2]	----------				
Group 4f2: RsD, RsE.	Red oak [3]	43	2	95	Red pine, jack pine, and eastern redcedar.	Moderate	Severe	Moderate on north- and east-facing slopes; severe on south- and west-facing slopes.
Group 4o1: JoA	Red oak	45	[2]	100	Eastern white pine, white spruce, and red pine.	Slight	Slight	Slight.
	Red maple	45	[2]	50				
Group 6w1: Mf. These soils are not suited to woodland management.								
Group 6s1: RkE, Ro. These soils are not suited to woodland management.								

[1] These soils are generally used for producing farm crops and are not naturally forested: FoA, FoB, GrA, GrB, GrC2, MdB2, MdC2, MdD2, MsA, MsB, MsC2, PnA, PnB, ReB, RtB2, RtC2, RtD2 and RtE.

[2] Data estimated for this kind of tree.

[3] The data are also estimates for northern red oak, black oak, and northern pin oak.

other layers in the soil that restrict roots are examples.

Subclass c (clayey soils). Soils that are restricted or limited for woodland use or management because of the kind or amount of clay in the upper

Erosion hazard refers to the potential hazard of soil losses in woodland. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce soil losses; *severe* if special methods

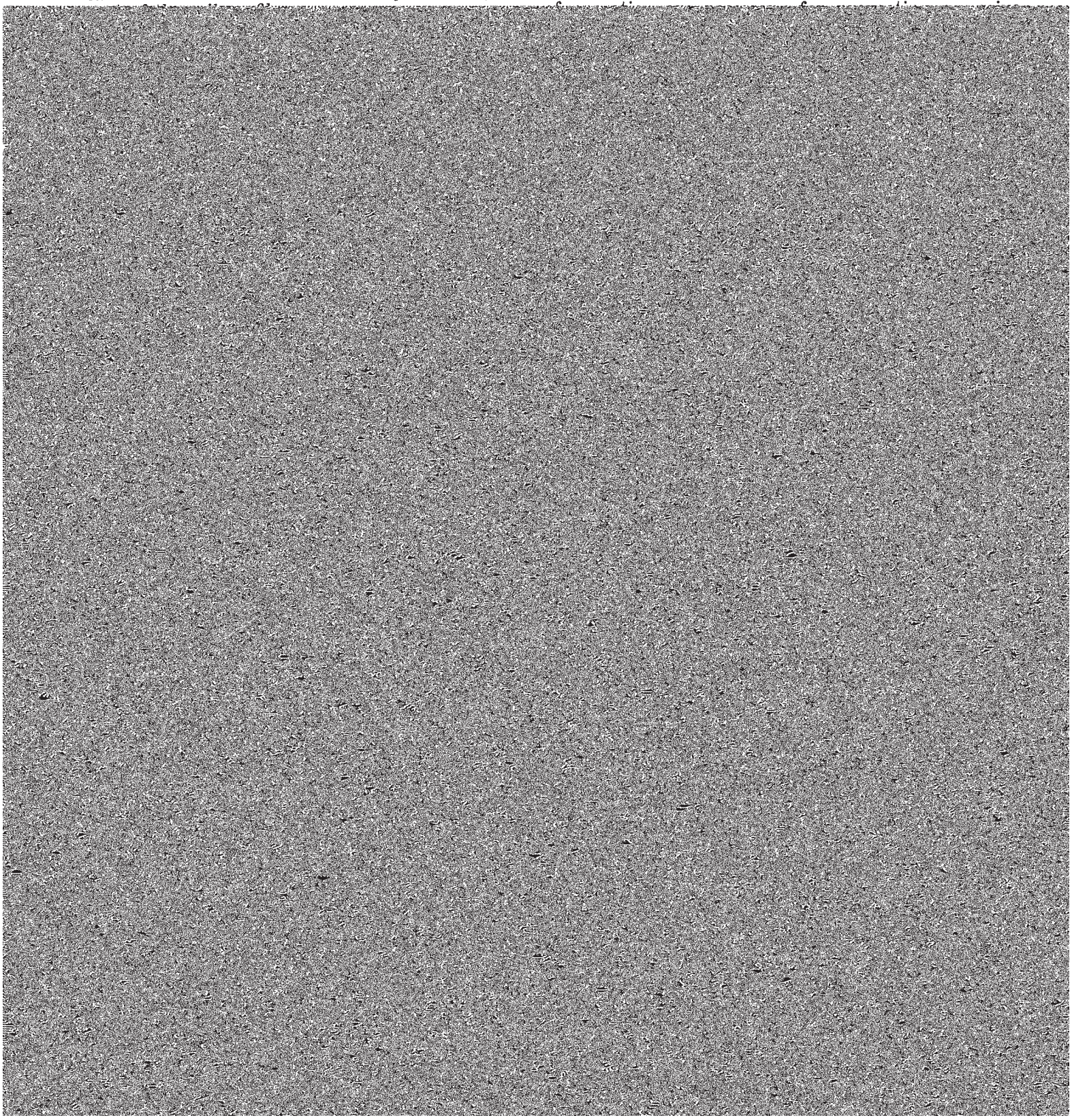


TABLE 4.—*Trees suitable for planting*

[The first letter in parentheses following the plant name indicates the location: A is for sunny sites and B is for partly shady sites. Other letters indicate height: S is less than 30 feet, M is 30 to 60 feet, and L is more than 60 feet. These letters indicate

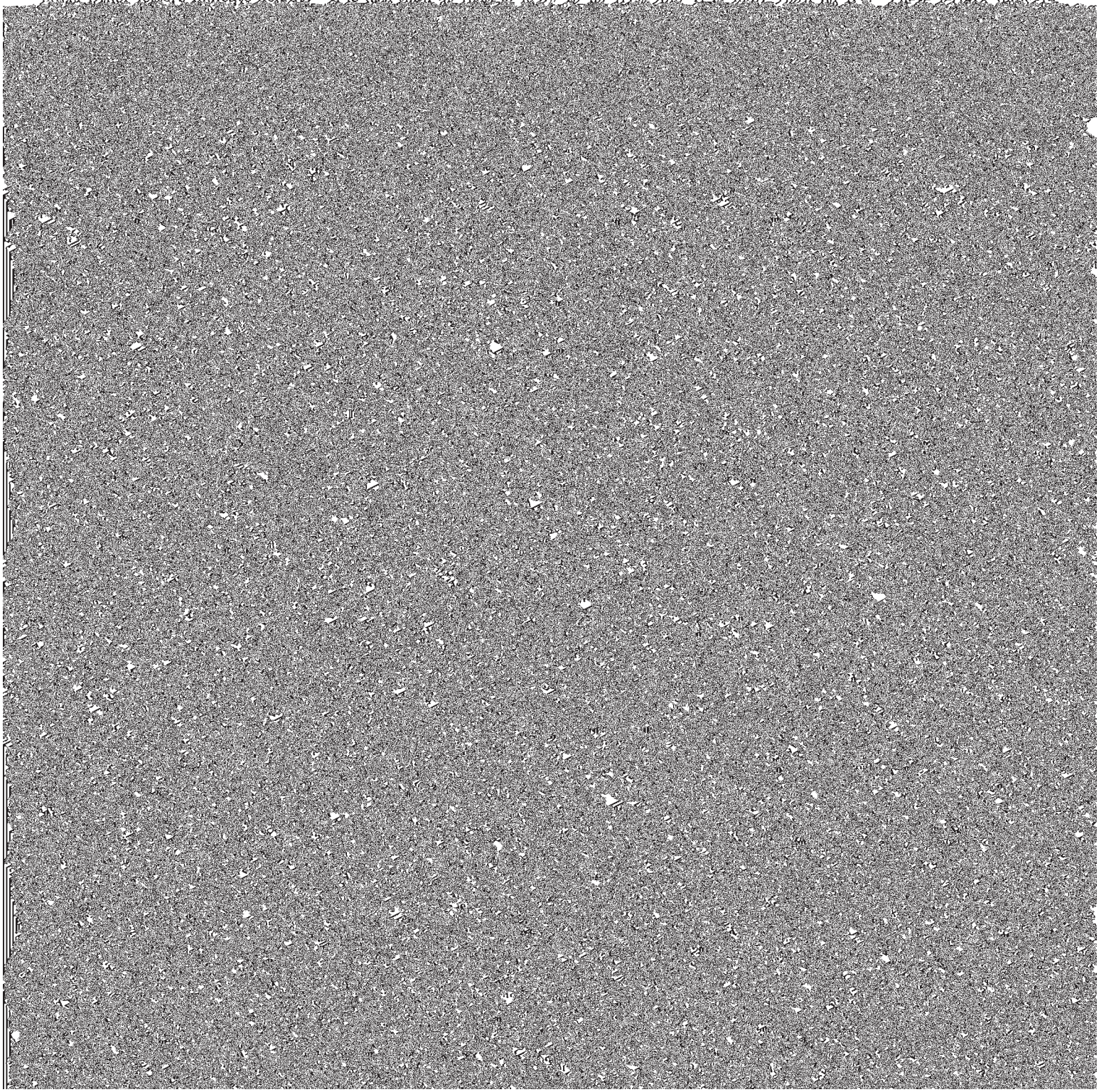
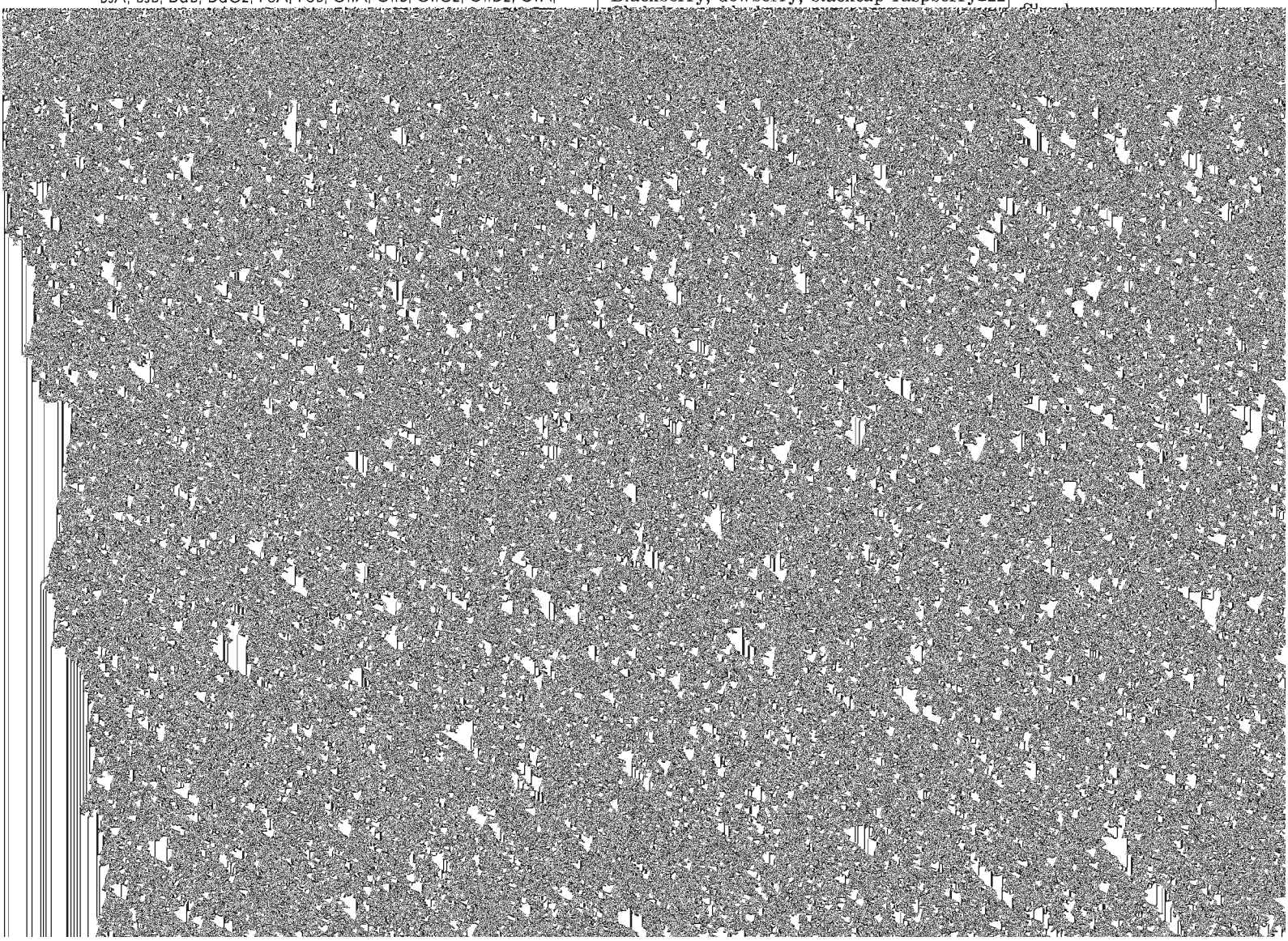


TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, fine textured to coarse textured soils that have moderate to very high available water capacity. BsA, BsB, DdB, DdC2, FoA, FoB, GnA, GnB, GnC2, GnD2, GrA,	Arborvitae	Shrub
	Autumn-olive	Shrub
	Barberry, Japanese	Shrub
	Bittersweet	Vine
	Blackberry, dewberry, blackcap raspberry	Bramble



suited to the soils

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
10–15	X	X	X	X		
6	X	X	X	X		
	X	X		X	X	X
1–5				X	X	X

TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 2: Moderately well drained to excessively drained, coarse textured or shallow soils with moderate to very low available water capacity. BpB, BpC2, BpD, BrB, GaB, GaC, GbC, GbD, OaB, OaC, OaD, OmB, OmC2, RaB, RaC, RhB2, RhC2, RhD2, RsD, RsE, TuB, UrB, UrC2, UrD2.	Arborvitae	Shrub
	Autumn olive	Shrub
	Barberry, Japanese	Shrub
	Bayberry or waxmyrtle	Shrub
	Bittersweet	Vine
	Blackberry, dewberry, blackcap raspberry	Bramble
	Chokeberry, black	Shrub
	Cotoneaster	Shrub
	Crabapple	Shrub
	Currant, alpine	Shrub
	Dogwood, gray	Shrub
	Filbert (hazelnut)	Shrub
	Forsythia	Shrub
	Grape, wild	Vine
	Hawthorn or thornapple	Shrub
	Honeysuckle	Shrub
	Juniper, creeping	Shrub
	Juniper, Pfitzer	Shrub
	Lilac	Shrub
	Maple, Amur	Shrub
	Mockorange	Shrub
	Myrtle or periwinkle	Vine
	Ninebark, common	Shrub
	Peashrub, Siberian	Shrub
	Pine, mugho	Shrub
	Plum, American	Shrub
	Privet, Amur	Shrub
	Privet, Regels border	Shrub
	Redcedar, eastern	Shrub
	Russian-olive	Shrub
	Snowberry	Shrub
	Spirea, Anthony Waterer	Shrub
	Spirea, vanhoutte	Shrub
	Sumac, fragrant	Shrub
	Sumac, smooth	Shrub
	Sumac, staghorn	Shrub
	Viburnum, blackhaw	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, rafinesque	Shrub
	Viburnum, wayfaringtree	Shrub
	Virginiacreeper	Vine
	Willows, shrubby types including pussy willow.	Shrub
Group 3: Somewhat poorly drained and poorly drained mineral soils and land type. An, Bb, Co, Gf, GhA, GkA, JoA, KbA, MaA, McA, Mh, Os, Pr, Py, ZtA.	Arborvitae	Shrub
	Autumn-olive	Shrub
	Bayberry or waxmyrtle	Shrub
	Dogwood, gray	Shrub
	Dogwood, pagoda	Shrub
	Dogwood, redosier	Shrub
	Dogwood, roundleaf	Shrub
	Dogwood, silky	Shrub
	Elder, American	Shrub
	Hawthorn or thornapple	Shrub
	Honeysuckle	Shrub
	Ninebark, common	Shrub
	Plum, American	Shrub
	Russian-olive	Shrub
	Spirea, narrow-leaf	Shrub
	Spirea, vanhoutte	Shrub
	Viburnum, American cranberry-bush	Shrub
	Viburnum, mapleleaf	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, wayfaringtree	Shrub
	Willows, shrubby types including pussy willow.	Shrub
	Winterberry, common	Shrub

suited to the soils—Continued

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
10–15	X	X	X	X		
6	X	X	X	X		
5–9	X	X		X		X
	X	X		X	X	X
1–5				X	X	X
1–3	X	X		X	X	X
4–8		X	X	X		
10–25		X	X	X	X	
6–7	X	X	X			
6–10	X			X	X	
5–8	X			X	X	
4–8	X	X				
	X			X	X	X
5–15	X			X	X	
6–12	X	X	X	X		
1–2		X		X	X	X
8–10		X		X		
8–10		X	X		X	
1		X	X			
6–9		X	X			
1	X	X			X	X
6–9	X	X	X		X	
10–15			X	X	X	
6–9		X		X		
10–15	X			X	X	
10	X		X	X		
6–9	X		X	X		
6–9	X		X	X	X	
15+		X	X	X		
3–4	X	X		X	X	X
2–3		X				
5–6	X	X	X			
3	X	X		X	X	X
6–10				X	X	
10–15	X			X	X	
8–10	X		X	X	X	
9–12	X		X	X	X	
2–4	X			X	X	
4–9	X	X		X	X	
	X			X	X	X
2–8		X	X	X	X	
3–7		X	X	X		
10–15	X	X	X	X		
5–9	X	X		X		X
6–10	X			X	X	
10–15	X			X	X	
3–9	X					
3–9	X			X	X	X
6–10	X		X	X	X	
3–10				X	X	X
5–15	X			X	X	
6–12	X	X	X	X		
6–9	X	X	X		X	
10–15	X			X	X	
15+		X	X	X		
3–4					X	
5–6	X	X	X			
7–9	X	X	X			
3–5	X			X	X	
9–12	X		X	X	X	
4–9		X		X	X	
2–8	X	X	X	X	X	
6–9				X	X	
	X					

TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 4: Very poorly drained organic soils. Ad, Ed, Ho, Pa, We.	Arborvitae	Shrub
	Dogwood, redosier	Shrub
	Dogwood, roundleaf	Shrub
	Dogwood, silky	Shrub
	Elder, American	Shrub
	Honeysuckle	Shrub
	Ninebark, common	Shrub
	Viburnum, American cranberry-bush	Shrub
	Viburnum, mapleleaf	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, wayfaringtree	Shrub
	Willows, shrubby types including pussy willow.	Shrub
	Winterberry, common	Shrub

Wildlife[3]

The soils of Green Lake County differ widely in physical and chemical characteristics. These characteristics affect the kind and amounts of vegetation and wildlife the soils will support. There is a direct relationship between soil fertility and wildlife kinds and abundance. This correlation is applicable to upland and wetland soils, plants and animals, and domestic animals and wildlife.

Food and cover planting on lands used primarily or secondarily for wildlife encourage wildlife. Stripcropping, fertilization, and tree planting in pastures, woodland, or other areas benefit wildlife.

Most of the major soils are suitable for fairly intensive farming. They have a high potential for wildlife but, because of other uses, there is little wildlife habitat.

The soils of Green Lake County are in ten wildlife groups. Soils in group 9 do not occur in Green Lake County. Groups 1 and 3, the somewhat excessively drained, well drained, and moderately well drained sandy and loamy soils, have the most acreage in the county. These groups are capable of producing good habitat for most wildlife. Group 5, the well drained and moderately well drained prairie soils, also has large amounts of acreage.

The most important soil groups for wildlife habitat are groups 6 and 7, the somewhat poorly drained to very poorly drained mineral soils and land types, and group 8, the organic soils. These groups contain the valuable wetlands and cover about 80,000 acres. In 1938, Green Lake County had about 60,000 acres in wetlands. Since 1938, 16,000 acres of wetlands have been converted to other uses and presently about 44,000 acres remain in wetlands. Wetland groups 3, 4, and 5 have increased from about 1,000 acres in 1938 to about 3,600 acres. Private landowners have developed wetlands, and public agencies have purchased and improved wetlands.

In table 6, wildlife groups are rated for seven elements of wildlife habitat. The ratings indicate relative suitability of various elements. A rating of *good* means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results, however.

A rating of *poor* means the element of wildlife habitat faces severe limitations for the designated use. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

Grain and seed crops include corn, oats, sorghums, wheat, barley, rye, or soybeans.

Grasses and legumes include switchgrass, bromegrass, timothy, fescue, alfalfa, red clover, sweet clover, and vetch.

Wild herbaceous upland plants include native or introduced grasses, legumes, and forbs that provide food and cover for upland wildlife and are mainly established by natural means. Important plants are bluegrass, roundhead lespedeza, beggarstick, aster, and goldenrod.

Woody plants include hardwood trees and shrubs and coniferous trees. Hardwood trees such as oaks, maples, cherry, and nut trees furnish mast, fruit, seeds, dens, cover, and browse for wildlife. Shrubs are low-growing woody plants, including conifers less than 8 feet tall, that furnish fruit, seeds, browse, and cover for wildlife. Examples are viburnums, dogwood, and hazelnut. Coniferous trees that are more than 8 feet tall furnish seeds, fruit, browse, and cover for

[3]By LAVERNE C. STRICKER, biologist, Soil Conservation Service, at Madison.

suited to the soils—Continued

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
3–9	X					
3–9	X			X	X	X
6–10	X		X	X	X	
3–10				X	X	X
6–12	X	X	X	X		
6–9	X	X	X		X	
7–9	X	X	X	X	X	
3–5	X			X	X	
9–12	X		X	X	X	
4–9	X	X		X	X	
2–8		X	X	X	X	
6–9	X			X	X	

wildlife. Examples are pines, firs, spruce, tamarack, and cedar.

Wetland plants for food and cover include forbs, grasses, sedges, aquatic plants, and woody plants that grow well in wet areas. They furnish fruit, seeds, browse, and cover for wildlife that live in wet areas and on or near open water. Examples are smartweed,

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 8, the soils of Green Lake County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, golf course

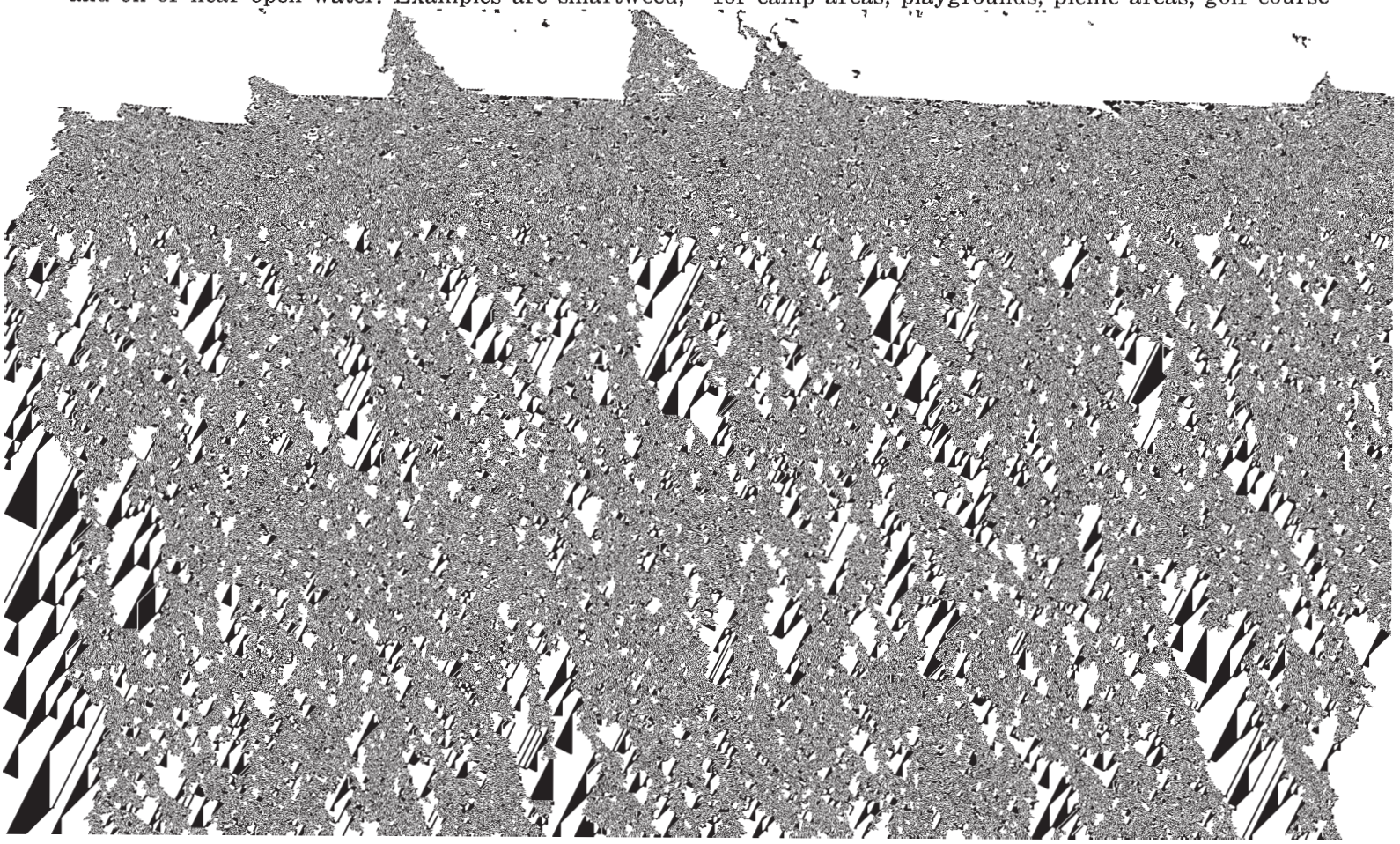


TABLE 6.—*Suitability of the*

Wildlife groups and map symbols	Grain and seed crops	Grasses and legumes
Group 1: Somewhat excessively drained, well drained, and moderately well drained soils that are loamy throughout and not subject to flooding. BpB, BpC2, BpD, DdB, DdC2, GnA, GnB, GnC2, GnD2, KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE, KwA, KwB, KwC2, KwD2, LaB, LaC2, LaD2, Lb, LrC2, LrD2, LvB, LvC2, LvD2, MnB, MnC2, OkB, OkC, OmB, OmC2, ScA, ScB, ScC2, SnB, SnC2, SnD2.	Good where slope is 0 to 6 percent, fair where slope is 6 to 12 percent, and poor where slope is more than 12 percent; water erosion is a hazard.	Good where slope is 0 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.
Group 2: Well drained and moderately well drained soils that have a clayey subsoil. BsA, BsB, TuB.	Good	Good
Group 3. Somewhat excessively drained, well drained, and moderately well drained soils that are moderately coarse textured or coarse textured. BrB, GaB, GaC, GbC, GbD, OaB, OaC, OaD, RaB, RaC, UrB, UrC2, UrD2.	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent; water erosion is a hazard.	Fair
Group 4: Soils with shallow or very shallow rooting depth. RhB2, RhC2, RhD2, RsD, RsE.	Fair where slope is 0 to 6 percent; poor where slope is more than 6 percent; water erosion is a hazard.	Good where slope is 0 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.
Group 5: Well drained and moderately well drained soils that have a dark-colored surface layer and are loamy throughout. FoA, FoB, GrA, GrB, GrC2, MdB2, MdC2, MdD2, MsA, MsB, MsC2, PnA, PnB, ReB, RtB2, RtC2, RtD2, RtE.	Good where slope is 0 to 12 percent; very poor where slope is more than 12 percent; droughty; soil blowing is a hazard.	Good where slope is 0 to 12 percent; fair where slope is more than 12 percent.
Group 6: Somewhat poorly drained soils. JoA, KbA, MaA, McA, ZtA.	Good where soil has been drained; fair where soil is undrained and wet.	Good where soil has been drained; fair where soil is undrained and wet; few species suited.
Group 7: Poorly drained and very poorly drained soils and land types.	Good where soil has been	Fair where soil has been

soils for wildlife habitat

Wild herbaceous upland plants	Woody plants		Wetland plants for food and cover	Shallow and deep water developments
	Hardwood trees and shrubs	Coniferous trees		
Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; permeability is moderate or moderately rapid.
Good	Good	Good	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Poor: permeability is moderately slow or rapid; slowly permeable clay.
Good	Good	Good	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Very poor: permeability is moderately rapid or rapid.
Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Very poor: permeability is very rapid; creviced bedrock.
Good	Fair	Fair	Very poor	Very poor.
Fair; wet soil; some species not suited.	Fair; wet soil; some hardwoods are not suitable.	Fair; wet soil; some conifers are not suitable.	Good	Good where slope is 0 to 2 percent; fair where slope is more than 2 percent; wet soil; permeability is moderate or rapid in some soils.
Very poor; very wet soil; few plants are suitable.	Poor; very wet soil; few hardwoods are suitable.	Poor; very wet soil; few plants are suitable.	Good	Good.
Very poor; wet soil; few plants are suitable.	Poor; wet soil; some plants are suitable.	Fair; wet soil; some plants are not suitable.	Good	Good where slope is 0 to 2 percent; fair where slope is more than 2 percent; wet soil.
Fair where slope is 0 to 12 percent; poor where slope is more than 20 percent; some plants are not suitable; insufficient soil moisture.	Poor; few plants are suitable; insufficient soil moisture.	Poor; few plants are suitable; insufficient soil moisture.	Very poor; insufficient soil moisture.	Very poor: shallow to creviced dolomite or igneous rock.

TABLE 7.—*Elements of habitat needed by wildlife*

[The symbol 1 means that the element of habitat is of little value for the survival of that kind of wildlife; 2 means that it is of

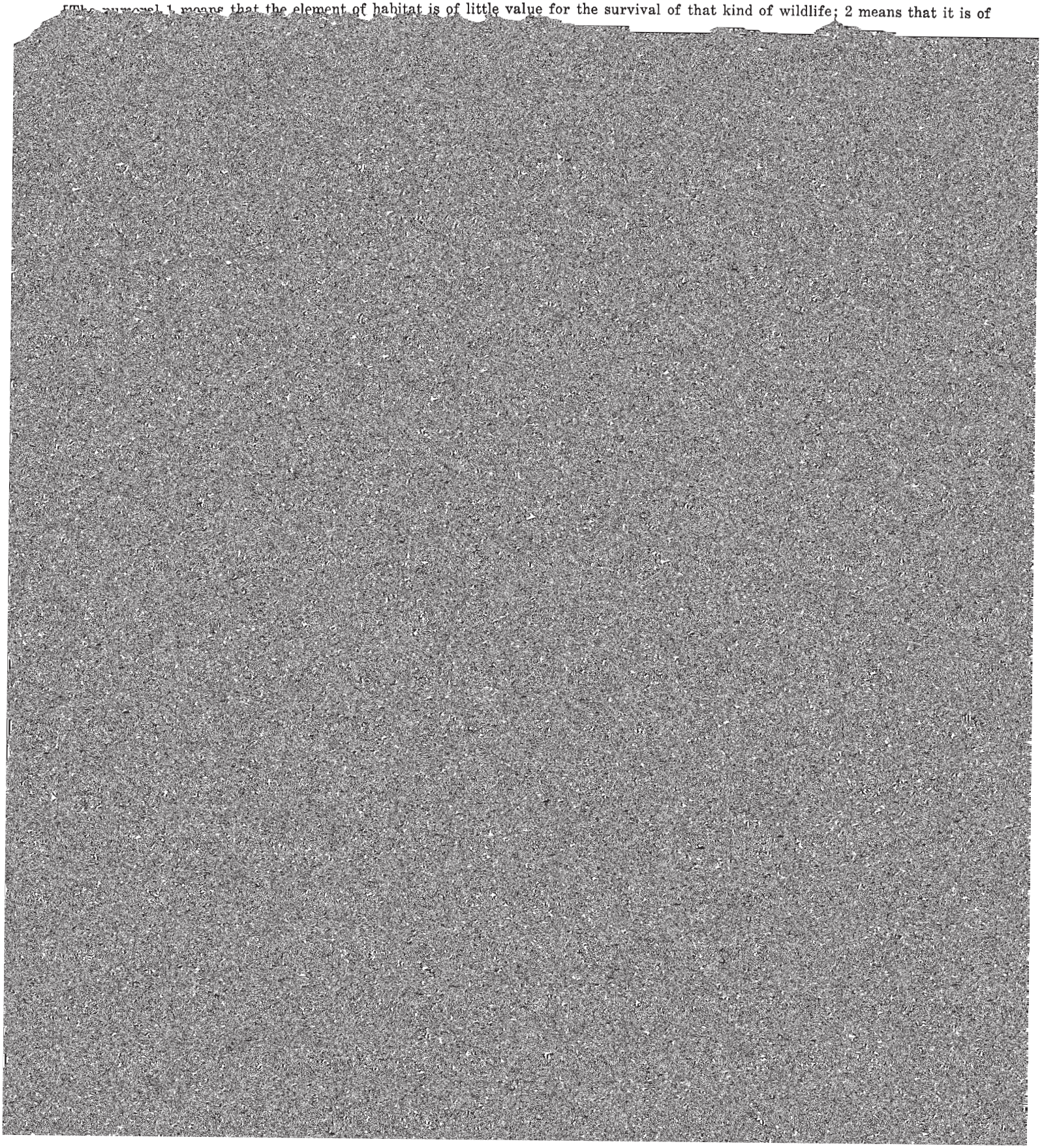


Figure 15.—Corn growing in an area of Oakville soils is in the foreground. Houghton soils are in the wetland area. Alfalfa and pine in the background are growing in an area of Boyer and Rodman soils. These different soils provide good habitat for

TABLE 8.—*Recreational limitations of the soils*

Recreation groups and	Camp areas	Playgrounds	Picnic areas	Golf course	Paths and trails

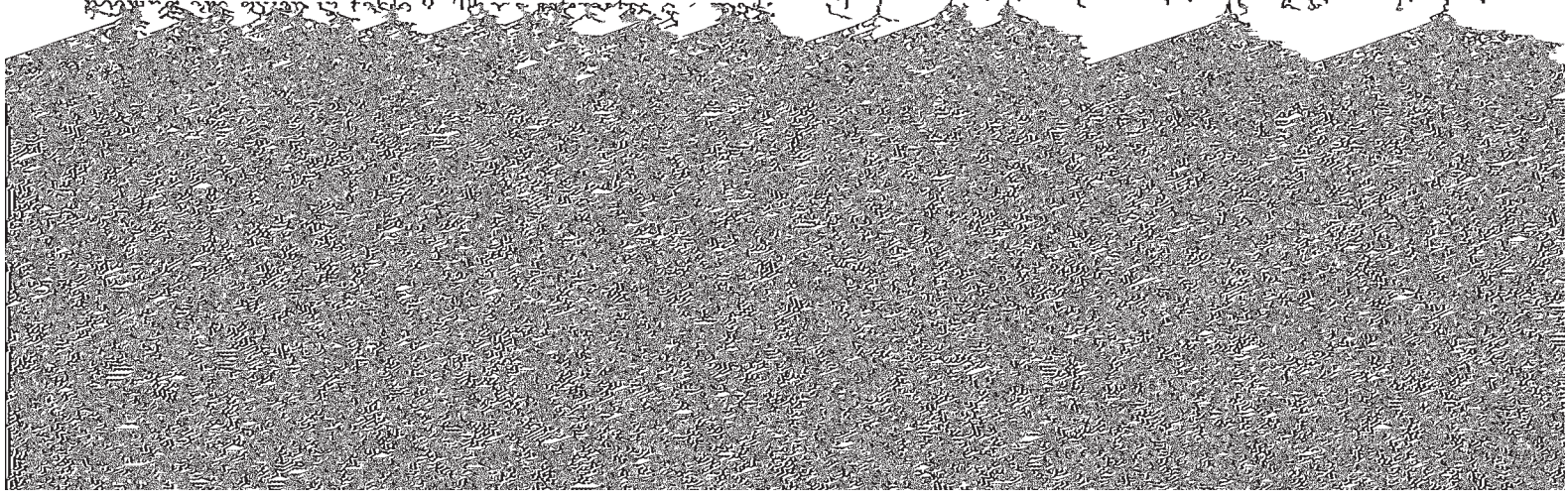
TABLE 8.—*Recreational Limitations of the soils*—Continued

Recreation groups and map symbols	Camp areas	Playgrounds	Picnic areas	Golf course fairways	Paths and trails
Group 6: Somewhat poorly drained soils. JoA, KbA, MaA, McA, ZtA.	Severe: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.
Group 7: Poorly drained and very poorly drained soils. An, Bb, Co, Gf, GhA, GkA, Mh, Os, Pr, Py.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.
Group 8: Very poorly drained organic soils and marsh. Ad, Ed, Ho, Mf, Pa, We.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.

way construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 12; the estimated classification, without group index numbers, is given in table 9 for all soils mapped in the survey area.

Soil properties

Several estimated soil properties significant in engi-



percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from semisolid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 9, but in table 12 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those

TABLE 9.—*Estimated soil properties*

[The symbol > mean greater than;

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Adrian: Ad	[2] 0–1	0–36	Muck	Pt		
		36–60	Fine sand	SP	A–3	
Alluvial land, wet: An. Too variable to be estimated.						
Barry: Bb	[2] 0–1	0–13	Loam	CL or CL–ML	A–4	
		13–24	Clay loam	CL	A–6	0–2
		24–31	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		31–60	Gravelly loamy sand	SM	A–2	2–7
Boyer: BpB, BpC2, BpD	>5	0–14	Loamy fine sand	SM	A–2	
		14–27	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		27–60	Sand and gravel	SP	A–1	0–5
Brems: BrB	2–3	0–9	Loamy fine sand	SM	A–2	
		9–38	Fine sand	SP	A–3	
		38–60	Sand	SP	A–3	
Briggsville: BsA, BsB	3–>5	0–13	Silt loam	ML or CL	A–4 or A–6	
		13–34	Silty clay	CH	A–7	
		34–60	Silty clay loam, silty clay and clay.	CH	A–7	
Colwood: Co	[2] 0–1	0–10	Silt loam	ML or CL	A–4 or A–6	
		10–22	Heavy loam	CL	A–6	

significant to engineering

the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
						6.0–20.0	0.35–0.45	6.1–7.3		High	Moderate.
100	90–100	65–80	1–5		[2] NP	6.0–20.0	0.03–0.08	6.6–7.3	Low	High	Low.
95–100	90–100	85–95	60–70	20–29	5–10	0.6–2.0	0.20–0.22	6.1–7.3	Low	High	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.1–7.3	Moderate	High	Low

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Griswold: GrA, GrB, GrC2	>5	0–12	Silt loam	ML or CL–ML	A–4	
		12–24	Clay loam	CL	A–6	0–2
		24–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Houghton: Ho	[2] 0–1	0–60	Muck	Pt		
Joy: JoA	[2] 1–3	0–11	Silt loam	ML or CL–ML	A–4	
		11–57	Silt loam	CL or CL–ML	A–4 or A–6	
		57–65	Silt loam	CL or CL–ML	A–4 or A–6	
Kibbie: KbA	[2] 1–3	0–21	Loam	CL or CL–ML	A–4	
		21–33	Clay loam	CL	A–6	
		33–60	Silt loam, silt and very fine sand.	CL or CL–ML	A–4	
Kidder: KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE.	>5	0–11	Fine sandy loam	SM or SC–SM	A–2 or A–4	
		11–34	Sandy clay loam	SC, SC–SM, CL, or CL–ML	A–4 or A–6	0–2
		34–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Knowles: KwA, KwB, KwC2, KwD2	>5	0–22	Silt loam	ML or CL–ML	A–4	
		22–35	Silty clay loam	CL	A–6	
		35–60	Dolomite.			
Lapeer: LaB, LaC2, LaD2, Lb	>5	0–6	Loamy fine sand	SM	A–2	
		6–28	Silt loam	SC, SM or SC–SM	A–2 or A–4	0–2
		28–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
LeRoy: LrC2, LrD2	>5	0–6	Silt loam	ML or CL–ML	A–4	
		6–10	Silty clay loam	CL	A–6	
		10–18	Clay loam	CL	A–6	0–5
		18–60	Very gravelly sandy loam.	SM, SP–SM, GM or GP–GM	A–2 or A–4	3–10
Lomira: LvB, LvC2, LvD2	>5	0–23	Silt loam	ML or CL–ML	A–4	
		23–29	Silty clay loam	CL	A–6	
		29–35	Clay loam	CL	A–7	0–2
		35–60	Very gravelly sandy loam.	SM, SP–SM, GM or GP–SM	A–2 or A–4	3–10
Manawa: MaA	[2] 1–3	0–9	Silt loam	ML or CL	A–7	
		9–26	Clay	CH	A–7	
		26–60	Silty clay loam	CL	A–7	
Marcellon: McA	[2] 1–3	0–13	Loam	CL or CL–ML	A–4	0–1
		13–35	Clay loam	CL	A–6	0–1
		35–60	Gravelly sandy loam	SM	A–2 or A–4	3–5
Markesan: MdB2, MdC2, MdD2	>5	0–16	Silt loam	ML or CL–ML	A–4	
		16–60	Very gravelly sandy loam.	SM or SP–SM	A–2 or A–4	3–10
Marsh: Mf. Too variable to be rated.	[2] 0–1					
Marshan: Mh	[2] 0–1	0–28	Silt loam	ML or CL	A–4 or A–6	
		28–33	Loam	CL or CL–ML	A–4 or A–6	
		33–60	Sand	SP	A–3	

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
--------	100	90–100	70–90	10–19	2–5	0.6–2.0	0.22–0.24	6.6–7.8	Low --------	Low --------	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	5.6–6.0	Moderate ----	Moderate ----	Moderate.
80–90	75–85	60–70	30–40	--------	NP	0.6–2.0	0.08–0.10	6.1–8.4	Low --------	Low --------	Low.
--------	--------	--------	--------	--------	--------	6.0–20.0	0.25–0.35	6.1–7.3	--------	High -------	Moderate.
--------	100	90–100	70–90	20–29	2–5	0.6–2.0	0.22–0.24	6.6–7.3	Low --------	High -------	Low.
--------	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	5.1–5.5	Moderate ----	High -------	Moderate.
--------	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	6.6–7.3	Moderate ----	High -------	Low.
100	95–100	85–95	60–75	20–29	5–10	0.6–2.0	0.20–0.22	5.6–7.8	Low --------	High -------	Moderate.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate ----	High -------	Low.
100	95–100	90–100	70–85	20–30	5–10	0.6–2.0	0.20–0.22	7.9–8.4	Moderate ----	High -------	Low.
90–100	85–95	60–70	30–40	10–20	2–6	2.0–6.0	0.16–0.18	5.6–6.5	Low --------	Low --------	Moderate.
95–100	90–100	80–95	36–55	20–29	5–15	0.6–2.0	0.16–0.18	6.6–7.8	Low --------	Moderate ----	Low.
80–90	75–90	60–80	30–40	--------	NP	0.6–2.0	0.08–0.10	7.9–8.4	Low --------	Low --------	Low.
--------	100	90–100	70–90	20–29	2–5	0.6–2.0	0.20–0.22	5.1–7.3	Low --------	Low --------	Moderate.
--------	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.1–7.8	Moderate ----	Moderate ----	Moderate.
100	90–100	65–85	15–25	--------	NP	2.0–6.0	0.10–0.12	6.6–7.3	Low --------	Low --------	Low.
90–100	85–95	60–80	30–40	<25	NP–10	0.6–2.0	0.12–0.14	6.1–6.5	Low --------	Low --------	Moderate.
75–90	75–85	60–70	20–40	--------	NP	0.6–2.0	0.08–0.10	7.4–8.4	Low --------	Low --------	Low.
--------	100	90–100	70–90	20–30	2–5	0.6–2.0	0.22–0.24	6.6–7.3	Low --------	Low --------	Low.
--------	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	6.6–7.3	Moderate ----	Moderate ----	Low.
95–100	90–100	85–95	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate ----	Moderate ----	Low.
55–75	50–70	45–60	10–40	--------	NP	0.6–2.0	0.05–0.07	7.9–8.4	Low --------	Low --------	Low.
--------	100	90–100	70–90	20–30	2–5	0.6–2.0	0.20–0.22	6.1–7.3	Low --------	Low --------	Low.
--------	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.6–6.0	Moderate ----	Moderate ----	Moderate.
75–85	75–85	70–100	55–80	41–50	22–30	0.6–2.0	0.15–0.19	6.1–6.5	Moderate	Moderate	Low

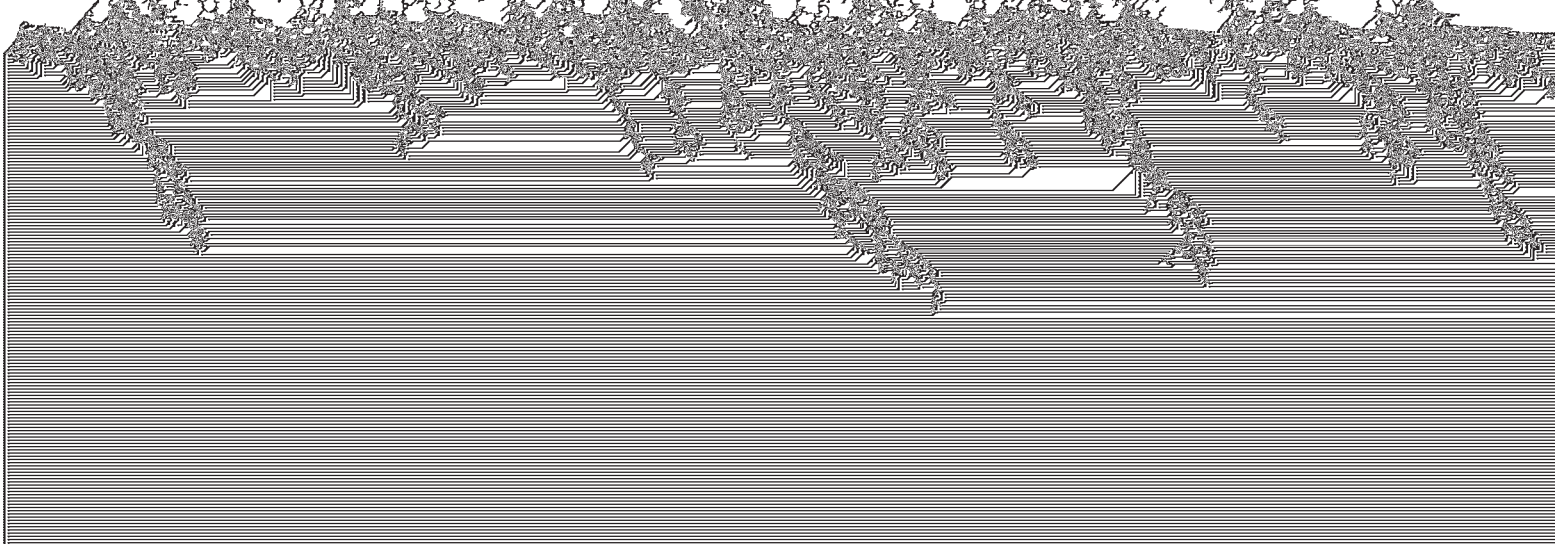


TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Mecan: MnB, MnC2	>5	0–18	Loamy fine sand	SM	A–2	
		18–46	Sandy loam	SM, SC or SC–SM	A–2 or A–4	0–2
		46–60	Gravelly loamy sand	SM	A–2	2–7
Mendota: MsA, MsB, MsC2	>5	0–13	Silt loam	ML or CL–ML	A–4	
		13–30	Heavy silt loam	CL or CL–ML	A–4 or A–6	
		30–33	Gravelly loam	CL, ML or CL–ML	A–4	0–5
		33–60	Very gravelly sandy loam.	SM or SP–SM	A–2 or A–4	3–10
Oakville: OaB, OaC, OaD	>5	0–53	Fine sand	SM	A–2	
		53–60	Sand	SM	A–2	
Okee: OkB, OkC	>5	0–25	Loamy fine sand	SM or SP–SM	A–2	
		25–45	Sandy loam	SC, SM or SC–SM	A–2 or A–4	0–2
		45–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Oshtemo: OmB, OmC2	>5	0–14	Loamy fine sand	SM	A–2	
		14–30	Heavy sandy loam	SC or SC–SM	A–2 or A–4	
		30–62	Loamy sand	SM or SP–SM	A–2	
		62–80	Sand	SP	A–3	
Ossian: Os	[a] 0–1	0–18	Silt loam	CH, MH, ML or CL	A–4, A–6 or A–7	
		18–60	Silt loam	CL	A–6	
Palms: Pa	[a] 0–1	0–26	Muck	Pt		
		26–41	Clay loam	CL	A–6	
		41–48	Sandy loam	SM or SC–SM	A–2 or A–4	
		48–60	Silty clay loam	CL	A–6	
Plano: PnA, PnB	3–>5	0–11	Silt loam	ML	A–4	
		11–41	Light silty clay loam	CL	A–6	
		41–54	Silt loam	CL or CL–ML	A–4 or A–6	
		54–58	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		58–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Poy: Pr	[a] 0–1	0–6	Silty clay loam	CL	A–7	
		6–36	Clay and silty clay	CH or MH	A–7	
		36–60	Fine sand	SP	A–3	
Poygan: Py	[a] 0–1	0–8	Silty clay loam	CL	A–7	
		8–32	Clay	CH	A–7	
		32–60	Silty clay	CL	A–7	
*Richford: RaB, RaC	>5	0–29	Loamy sand	SM or SP–SM	A–2	
		29–37	Heavy sandy loam	SC or SC–SM	A–2 or A–4	0–2
		37–44	Loamy sand	SM or SP–SM	A–2	
		44–60	Fine sand	SP	A–3	
Ripon: ReB	>5	0–23	Silt loam	ML	A–4	
		23–34	Silty clay loam	CL	A–6	
		34–60	Dolomite.			
Ritchey: RhB2, RhC2, RhD2	>5	0–8	Silt loam	ML or CL	A–4 or A–6	
		8–19	Gravelly clay loam	CL	A–7	0–5
		19–60	Dolomite.			
Rock land and Ritchey: RkE. Rock land is too variable to be rated. For Ritchey part of RkE, see Ritchey series.	>5					

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	90–100	65–85	15–25	--------	NP	2.0–6.0	0.10–0.12	6.6–7.3	Low --------	Low --------	Low.
90–100	85–100	60–95	30–45	15–25	2–10	0.6–2.0	0.12–0.14	6.1–7.3	Low --------	Low --------	Moderate.
80–90	75–85	50–80	15–30		NP	0.6–6.0	0.06–0.08	7.9–8.4	Low --------	Low --------	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Rock outcrop: Ro. Too variable to be rated.	>5					
Rodman: RsD, RsE	>5	0–11	Gravelly sandy loam	SM	A–2 or A–4	0–5
		11–60	Sand and gravel	GP or GP–GM	A–1	5–10
Rotamer: RtB2, RtC2, RtD2, RtE	>5	0–7	Sandy loam	SM or SC–SM	A–2 or A–4	0–1
		7–17	Light clay loam	CL	A–6	0–2
		17–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
St. Charles: ScA, ScB, ScC2	3–>5	0–9	Silt loam	ML or CL–ML	A–4	
		9–48	Heavy silt loam	CL or CL–ML	A–4 or A–6	
		48–54	Heavy sandy loam	SC or SC–SM	A–2 or A–4	
		54–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Sisson: SnB, SnC2, SnD2	>5	0–12	Loam	ML or CL–ML	A–4	
		12–37	Clay loam	SC or CL	A–6	
		37–60	Silt loam, silt and very fine sand.	ML or CL–ML	A–4	
Tustin: TuB	3–>5	0–8	Loamy fine sand	SM	A–2	
		8–34	Fine sand	SP	A–3	
		34–48	Clay	CH	A–7	
		48–60	Silty clay	CL	A–7	
Urne: UrB, UrC2, UrD2	>5	0–7	Loamy fine sand	SM	A–2	
		7–37	Fine sandy loam	SM or SC–SM	A–2 or A–4	
		37–60	Sandstone.			
Willette: We	[2] 0–1	0–30	Muck	Pt		
		30–60	Clay	CH	A–7	
Zittau: ZtA	[2] 1–3	0–8	Silty clay loam	CL	A–7	
		8–24	Clay	CH or MH	A–7	
		24–30	Clay loam	CL	A–6	
		30–42	Loamy fine sand	SM	A–2	
		42–60	Fine sand	SP	A–3	

[1] In many areas the pH of the surface layer is higher than the value given because of liming practices used in farming.

[2] Soils are subject to flooding, ponding, or occasional flooding of short duration.

Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, and that protective measures are needed if steel and more resistant concrete structures are placed in the soil.

Other soil properties significant to engineering uses are depth to bedrock and subsidence. Most soils in the survey area are deep enough over bedrock that bedrock generally does not affect their use. Some soils, however, are underlain by dolomite at comparatively shallow depths: Ritchey soils at a depth of 10 to 20 inches and Knowles and Ripon soils at a depth of 20 to 40 inches. Partly weathered, weakly cemented sandstone is at a depth of 20 to 40 inches in Gotham, sandstone substratum, and Urne soils.

Subsidence is settlement of organic soils or of soils containing the semifluid mineral layers. Ratings of soils for subsidence take into account the rapid initial

TABLE 10.—*Interpretations of*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Adrian: Ad	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability; frequent flooding.	Very severe: high water table; sidewall instability; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Alluvial land, wet: An	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.
Barry: Bb	Severe: high water table; frequent flooding.	Severe: high water table; gravelly substratum has moderately rapid permeability; stones.	Severe: high water table; stones.	Severe: high water table; stones.
Boyer: BpB, BpC2, BpD	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: very rapidly permeable sand and gravel substratum.	Severe: sand and gravel substratum that has sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Brems: BrB	Severe: seasonal high water table.	Severe: high water table; very rapid permeability.	Severe: high water table; sidewall instability.	Severe: high water table.
Briggsville: BsA, BsB	Severe: moderately slow permeability; seasonal high water table in places.	Slight where slope is 0 to 2 percent, moderate where slope is 2 to 6 percent.	Severe: clayey, difficult to work.	Severe: high shrink-swell potential; medium to low shear strength.
Colwood: Co	Severe: high water table; frequent flooding.	Severe: high water table; moderately permeable; frequent flooding.	Severe: high water table; frequent flooding; sidewall instability.	Severe: high water table; frequent flooding; medium shear strength to low shear strength.
Dodge: DdB, DdC2	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: seepage.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate: moderate shrink-swell potential; low strength; slope.
Edwards: Ed	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; frequent flooding.	Very severe: high water table; frequent flooding; sidewall instability.	Very severe: high water table; frequent flooding; susceptible to frost action; low strength.
Friesland: FoA, FoB	Slight or moderate: seasonal high water table in places.	Moderate: moderate permeability.	Slight	Slight or moderate: seasonal high water table in places.
Gotham: GaB, GaC, GbC, GbD.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: rapid permeability; seepage.	Severe: sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.
Granby: Gf	Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.

See footnotes at end of table.

engineering properties of the soils

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Very severe: high water table; rapid permeability; organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Poor: poorly graded sand in substratum; excess fines; high water table.	Poor: oxidizes rapidly; high water table.
Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding; loamy areas highly susceptible to frost action.	Poor: high water table; loamy areas highly susceptible to frost action.	Fair where sandy areas are poorly graded and have some fines, unsuited where loamy areas have excess fines.	Poor: high water table.
Severe: high water table; moderately rapid permeability in substratum; stones.	Severe: high water table; susceptible to frost action; stones.	Poor: high water table; stones.	Unsuited	Poor: high water table.
Severe: very rapid permeability in substratum; stones.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent; stones.	Good where slope is 1 to 12 percent, fair where slope is more than 12 percent: stones.	Good: poorly graded sand in substratum, fair for gravel in areas where gravel is in substratum.	Poor: sandy.
Severe: sandy; very rapid permeability.	Slight	Good	Good: poorly graded sand.	Poor: sandy.
Moderate: clayey, difficult to work; seasonal high water table in places.	Severe: high shrink-swell potential.	Poor: high shrink-swell potential.	Unsuited: fines	Fair: thin layer.
Severe: high water table; frequent flooding.	Severe: high water table; highly susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; susceptible to frost action; medium shear strength to low shear strength.	Unsuited: fines	Poor: high water table.
Slight	Moderate: susceptible to frost action; moderate shrink-swell potential.	Fair: moderate shrink-swell potential; susceptible to frost action.	Unsuited for sand, poor for gravel; fines.	Fair where slope is 2 to 6 percent, poor where slope is more than 6 percent: thin layers.
Very severe: high water table; frequent flooding; subsoil is organic material.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Unsuited: fines	Poor: oxidizes rapidly; high water table.
Slight or moderate: seasonal high water table in places.	Moderate: low strength; susceptible to frost action.	Fair: susceptible to frost action.	Unsuited: fines	Good.
Severe: rapid permeability; seepage; sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good	Good source of sand: the sandstone that underlies some areas of these soils is a good source of silica sand. Not suitable for gravel.	Poor: too sandy.
Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table.	Good source of sand, unsuited for gravel.	Poor: high water table; too sandy.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Granby, loamy subsoil variant: GhA.	Severe: high water table; rapid permeability in the upper part and moderate permeability in the lower part; frequent flooding.	Severe: high water table; rapid permeability in the upper part, and moderate permeability in the lower part; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.
Granby, clayey subsoil variant: GkA.	Severe: high water table; rapid permeability in the upper part and slow permeability in the lower part; frequent flooding.	Severe: high water table; rapid permeability in the upper part, and slow permeability in the lower part; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.
Grellton: GnA, GnB, GnC2, GnD2.	Slight or moderate where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: seasonal high water table in places.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Slight or moderate where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: seasonal high water table in places.
Griswold: GrA, GrB, GrC2	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.
Houghton: Ho	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Joy: JoA	Severe: seasonal high water table; ponding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Kibbie: KbA	Severe: seasonal high water table; ponding.	Severe: seasonal high water table.	Severe: seasonal high water table; sidewall instability.	Severe: seasonal high water table; medium shear strength to low shear strength.
Kidder: KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent: stones.	Moderate where slope is 0 to 12 percent, severe where slope is more than 12 percent: stones.
Knowles: KwA, KwB, KwC2, KwD2.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Lapeer: LaB, LaC2, LaD2, Lb	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Severe: high water table; rapid permeability in the upper part, and moderate permeability in the lower part; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table.	Unsuited: fines ------	Poor: high water table; too sandy.
Severe: high water table; rapid permeability in the upper part and slow permeability in the lower part; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table; clayey subsoil has medium shear strength or low shear strength and high shrink-swell potential.	Unsuited: fines ------	Poor: high water table; too sandy.
Slight or moderate where slope is 0 to 12 percent, moderate where slope is more than 12 percent; seasonal high water table in places.	Moderate: medium shear strength to low shear strength; susceptible to frost action.	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent: susceptible to frost action.	Unsuited: fines ------	Good where slope is 0 to 6 percent, fair where slope is 6 to 12 percent, poor where slope is more than 12 percent.
Slight: stones --------	Moderately susceptible to frost action.	Fair: susceptible to frost action; stones	Unsuited: fines ------	Good where slope is 0 to 6 percent, fair where

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
LeRoy: LrC2, LrD2	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Severe: moderate permeability; slope; stones.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Lomira: LvB, LvC2, LvD2	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: moderate permeability.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Manawa: MaA	Severe: seasonal high water table; slow permeability; occasional flooding.	Severe: seasonal high water table; occasional flooding.	Severe: seasonal high water table; too clayey; occasional flooding.	Severe: seasonal high water table; high shrink-swell potential; occasional flooding.
Marcellon: McA	Severe: seasonal high water table; occasional flooding.	Severe: seasonal high water table; occasional flooding; stones.	Severe: seasonal high water table; occasional flooding; stones.	Severe: seasonal high water table; occasional flooding; stones.
Markesan: MdB2, MdC2, MdD2.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Marsh: Mf	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.
Marshan: Mh	Severe: high water table; flooding common.	Severe: high water table; flooding common.	Severe: high water table; flooding common; sidewall instability.	Severe: high water table; flooding common; sidewall instability.
Mecan: MnB, MnC2	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.
Mendota: MsA, MsB, MsC2	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.
Oakville: OaB, OaC, OaD	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: very rapid permeability.	Severe: sidewall instability; slope.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Okee: OkB, OkC	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Severe: moderately rapid permeability in sandy upper layers.	Moderate where slope is 1 to 12 percent, severe where slope is more than 12 percent: sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.
Oshtemo: OmB, OmC2	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.[1]	Severe: very rapidly permeable sand substratum.	Severe: sand substratum has sidewall instability; stones.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent: stones.
Ossian: Os	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.
Palms: Pa	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability in the organic layer; frequent flooding.	Very severe: high water table; sidewall instability; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Plano: PnA, PnB	Slight or moderate: seasonal high water table in places.	Moderate: moderate permeability; seasonal high water table in places.	Slight: seasonal high water table in places.	Slight: seasonal high water table in places.
Poy: Pr	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; clayey subsoil; sandy substratum that has sidewall instability.	Severe: high water table; high shrink-swell potential; frequent flooding.
Poygan: Py	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; clayey subsoil; frequent flooding.	Severe: high water table; high shrink-swell potential; frequent flooding.
Richford: RaB, RaC	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: moderately rapid permeability; seepage.	Severe: sidewall instability; stones.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent; stones.
Ripon: ReB	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Ritchey: RhB2, RhC2, RhD2	Severe: fractured dolomite bedrock at a depth of 10 to 20 inches; slope.	Severe: fractured dolomite bedrock at a depth of 10 to 20 inches; slope.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Rock land and Ritchey: RkE.	Severe: fractured dolomite bedrock at or near the surface; slope.	Severe: fractured dolomite bedrock at or near the surface; slope.	Severe: dolomite bedrock at or near the surface; slope.	Severe: dolomite bedrock at or near the surface; slope.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Slight where slope is 1 to 12 percent, moderate where slope is more than 12 percent.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.	Good where slope is 1 to 12 percent, fair where slope is more than 12 percent.	Poor for sand, unsuited for gravel: fines.	Poor: too sandy.
Severe: very rapidly permeable sand substratum.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.	Good	Good: poorly graded sand in substratum; fair for gravel in lower part of subsoil and in substratum in some areas of this soil.	Poor: sandy.
Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding; susceptible to frost action.	Poor: medium shear strength to low shear strength; susceptible to frost action.	Unsuited: fines	Poor: high water table.
Very severe: high water table; rapid permeability; subsoil is organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material susceptible to frost action.	Unsuited: fines	Poor: oxidizes rapidly; high water table.
Moderate	Severe: susceptible to frost action.	Poor: susceptible to frost action; moderate shrink-swell potential.	Unsuited: fines	Good.
Severe: high water table; clayey subsoil; frequent flooding; sandy substratum has sidewall instability.	Severe: high water table; high shrink-swell potential; susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; high shrink-swell potential; medium shear strength to low shear strength; susceptible to frost action.	Good for sand; unsuited for gravel; fines.	Poor: high water table; too clayey.
Severe: high water table; clayey subsoil; frequent flooding.	Severe: high water table; high shrink-swell potential; susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; high shrink-swell potential; medium shear strength to low shear strength; susceptible to frost action.	Unsuited: fines	Poor: high water table; thin layer; clayey.
Severe: moderately rapid permeability in subsoil; rapid permeability in substratum; seepage.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good	Good source of sand; unsuited for gravel; fines.	Poor: too sandy.
Severe: fractured dolomite bedrock at a	Severe: susceptible to frost action; dolomite	Poor: susceptible to frost action; dolomite	Unsuited: dolomite bedrock near the	Good.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Rock outcrop: Ro	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.
Rodman: RsD, RsE	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: very rapid permeability.[1]	Severe: very rapid permeability in sand and gravel substratum; slope.	Severe: sand and gravel substratum that has sidewall instability.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.
Rotamer: RtB2, RtC2, RtD2, RtE.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
St. Charles: ScA, ScB, ScC2	Slight or moderate where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.
Sisson: SnB, SnC2, SnD2	Slight where slope is 2	Moderate where slope	Moderate where slope	Moderate where slope

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Unsuited: igneous bedrock at the surface.	Unsuited: igneous bedrock at the surface.	Unsuited: igneous bedrock at the surface.
Severe: very rapid permeability; slope.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good where slope is 6 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.	Good: poorly graded gravel in substratum.	Poor: thin layer; gravelly.
Slight where slope is 2 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: stones.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: stones.	Fair where slope is 2 to 20 percent, poor where slope is more than 20 percent: susceptible to frost action.	Poor for sand and gravel: fines.	Fair where slope is 2 to 12 percent, poor where slope is more than 12 percent: thin layer.
Slight ----------	Severe: susceptible to frost action.	Poor: susceptible to frost action; moderate shrink-swell	Unsuited: fines ------	Fair: thin layer.

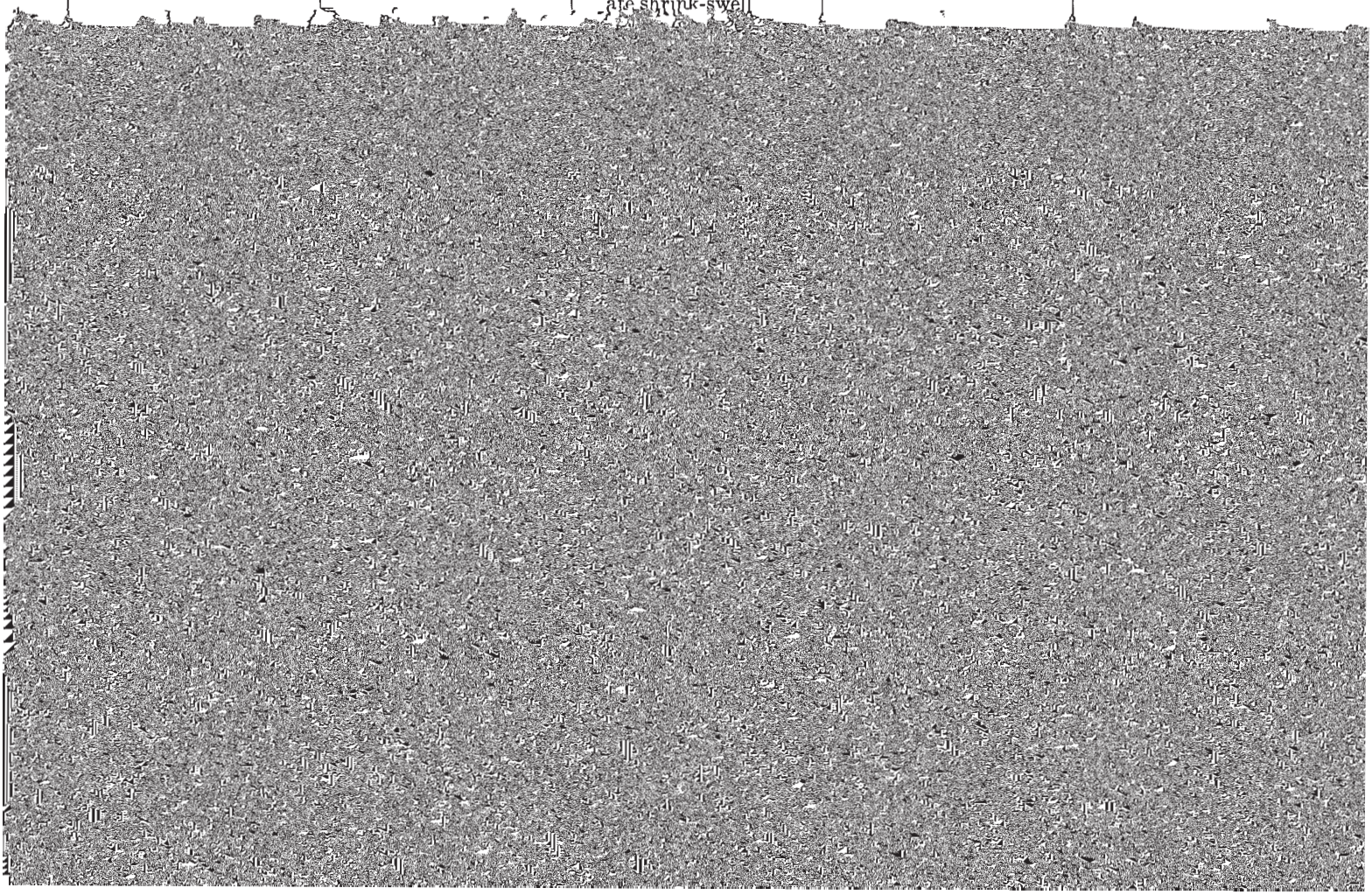


TABLE 11.—*Soil features affecting water management*

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Adrian: Ad	Rapid permeability; high water table.	Organic layer compressible, hard to pack; high permeability of compacted soil material in substratum.	High water table; rapid permeability; unstable when wet; frequent flooding.	High available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.
Alluvial land, wet: An	Variable permeability; frequent flooding; high water table.	Low to medium shear strength; medium to high permeability of compacted soil material; piping hazard.	High water table; variable permeability; frequent flooding; unstable when wet; ponding in places.	High to low available water capacity; variable permeability; poorly drained; frequent flooding.	Slope is 0 to 2 percent; poorly drained; frequent flooding.
Barry: Bb	Moderate permeability in subsoil, moderately rapid permeability in substratum; high water table.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; stones.	High water table; moderate permeability in subsoil, moderately rapid permeability in substratum; ponding.	High available water capacity; moderate permeability; poorly drained; stones.	Slope is 0 to 2 percent; poorly drained; calcareous till at a depth of 24 to 40 inches; stones.
Boyer: BpB, BpC2, BpD	Moderately rapid permeability in subsoil; very rapid permeability in substratum; slope.	Medium shear strength; medium to low permeability of compacted material; seepage; piping hazard; stones.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard; stones; slope.	Slope is 1 to 25 percent; complex slopes; sandy; may be difficult to vegetate; soil blowing hazard; sand and gravel at a depth of 24 to 40 inches; stones.
Brems: BrB	Very rapid permeability.	Medium shear strength; medium permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	Low available water capacity; very rapid permeability; soil blowing hazard.	Slope is 0 to 6 percent; sandy; difficult to vegetate; soil blowing hazard.
Briggsville: BsA, BsB	Moderately slow permeability; slope.	Medium to low shear strength; low permeability of compacted soil material; high shrink-swell potential.	Natural drainage is adequate.	Moderate available water capacity; moderately slow permeability; slope.	Slope is 0 to 6 percent; clayey subsoil; moderately slow permeability; slope.
Colwood: Co	Moderate permeability; high water table.	Medium to low strength; piping hazard.	High water table; moderately permeable; sidewall instability; susceptible to frost action.	Very high available water capacity; poorly drained; moderate permeability.	Slope is 0 to 2 percent; poorly drained.
Dodge: DdB, DdC2	Moderate permeability; seepage.	Medium to low shear strength; medium permeability to low permeability of compacted soil; piping hazard; stones in substratum.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 2 to 12 percent; complex slopes; erodes easily; calcareous till at a depth of 28 to 40 inches.
Edwards: Ed	Rapid permeability in organic layer, slow permeability in substratum; high water table.	Organic layer compressible, hard to pack; low permeability of compacted material in substratum.	High water table; rapid permeability in organic layer, slow permeability in substratum; frequent flooding.	Very high available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Friesland: FoA, FoB	Moderate permeability; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 0 to 6 percent; complex slopes.
Gotham: GaB, GaC, GbC, GbD.	Rapid permeability; seepage.	Medium shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	Low available water capacity; rapid permeability; soil blowing hazard; slope.	Slope is 1 to 20 percent; sandy; difficult to vegetate; blowing hazard; weakly cemented sandstone at a depth of 24 to 39 inches in some areas of this soil.
Granby: Gf	Rapid permeability; high water table.	Medium shear strength; high permeability of compacted soil material; piping hazard.	High water table; rapid permeability; unstable when wet.	Low available water capacity; poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; poorly drained; sandy; difficult to vegetate; blowing hazard.
Granby, loamy subsoil variant: GhA.	Rapid permeability; high	Medium shear strength;	High water table; rapid permeabil-	Moderate available water capacity;	Slope is 0 to 3 percent; poorly

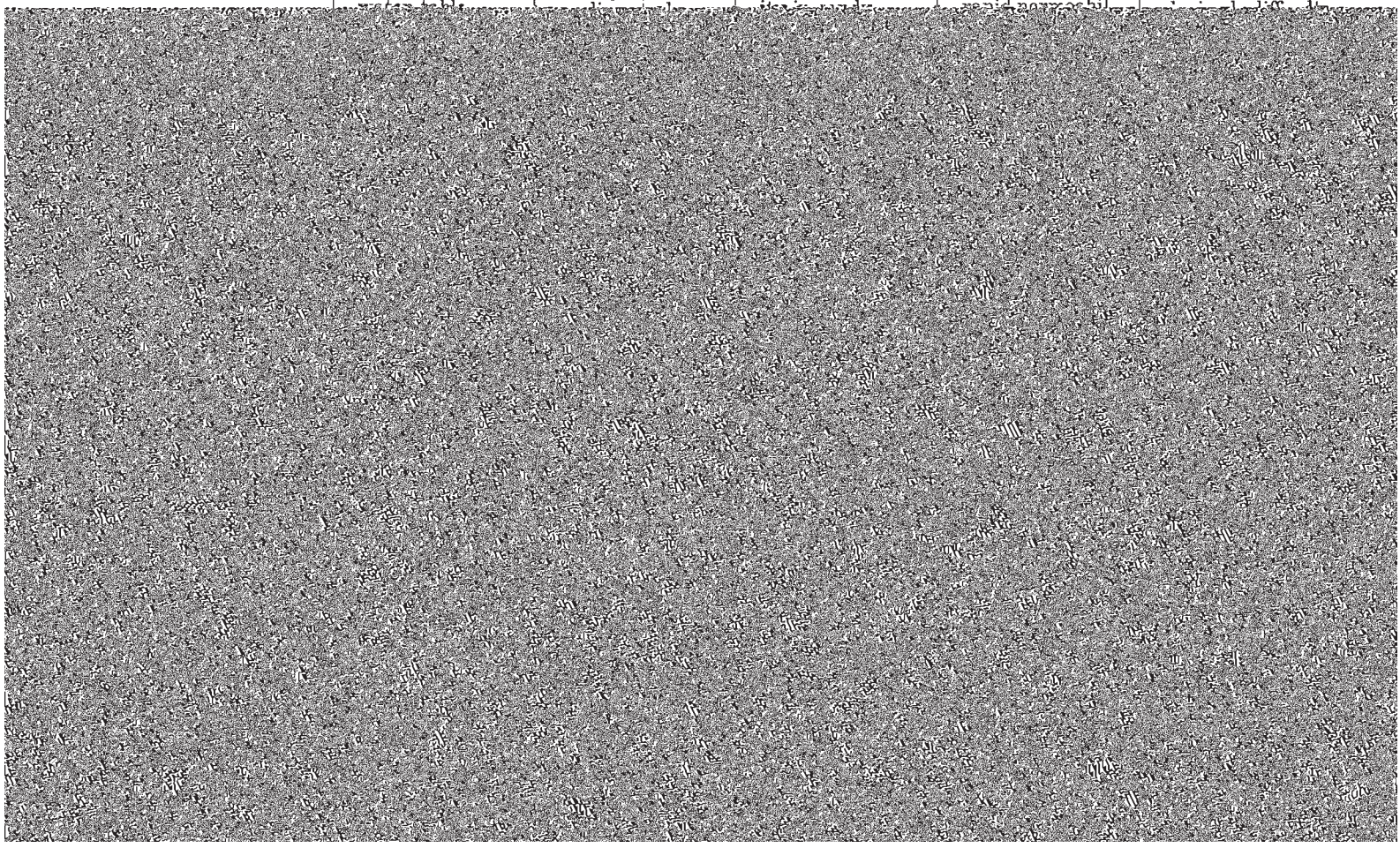


TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Joy: JoA	Moderate permeability; seasonal high water table.	Medium to low shear strength; medium to low permeability of compacted soil material.	Seasonal high water table; moderate permeability; ponding.	Very high available water capacity; moderate permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained.
Kibbie: KbA	Moderate permeability; seasonal high water table.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard.	Seasonal high water table; moderate permeability; unstable when wet.	High available water capacity; moderate permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained.
Kidder: KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE.	Moderate permeability; seepage; stones.	Medium to low shear strength; low permeability of compacted soil material; piping hazard; seepage; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; slope; stones.	Slope is 0 to 30 percent; complex slopes; calcareous till at a depth of 24 to 40 inches; stones; blowing hazard on fine sandy loam surface.
Knowles: KwA, KwB, KwC2, KwD2.	Moderate permeability; fractured dolomite bedrock at a depth of 20 to 40 inches; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; dolomite bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; dolomite bedrock at a depth of 20 to 40 inches; slope.	Slope is 0 to 20 percent; dolomite bedrock at a depth of 20 to 40 inches.
Lapeer: LaB, LaC2, LaD2, Lb.	Moderate permeability; slope; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; blowing hazard; slope.	Slope is 0 to 25 percent; complex slopes; calcareous till at a depth of 24 to 40 inches; stones; soil blowing hazard.
LeRoy: LrC2, LrD2	Moderate permeability; slope; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; very gravelly till at a depth of 12 to 24 inches; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; slope.	Slope is 6 to 20 percent; complex slopes; calcareous till at a depth of 12 to 24 inches; stones.
Lomira: LvB, LvC2, LvD2	Moderate permeability; slope.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; very gravelly till at a depth of 24 to 40 inches; stones.	Natural drainage is adequate	High available water capacity; moderate permeability; slope.	Slope is 2 to 20 percent; complex slopes; calcareous till at a depth of 24 to 40 inches.
Manawa: MaA	Slow permeability;	Medium to low	Seasonal high	High available	Slope is 0 to 3 per-

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Marcellon: MeA	Moderate perme-	Medium to low	Seasonal high	High available	Slope is 0 to 3 per-

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Oshtemo: OmB, OmC2	Moderately rapid permeability in subsoil; very rapid permeability in substratum; slope.	Medium shear strength; medium to low permeability of compacted soil material; seepage; piping hazard; stones.	Natural drainage is adequate.	Moderate available water capacity; moderately rapid permeability; soil blowing hazard; stones; slope.	Slope is 1 to 12 percent; sandy; may be difficult to vegetate; soil blowing hazard; sand or sand and gravel at a depth of 40 to 66 inches; stones.
Ossian: Os	Moderate permeability; high water table.	Medium to low shear strength; low permeability of compacted soil material.	High water table; moderate permeability; ponding.	Very high available water capacity; moderate permeability; poorly drained.	Slope is 0 to 2 percent; poorly drained; frequent flooding.
Palms: Pa	Rapid permeability in organic layer; moderate permeability in substratum; high water table.	Organic layer compressible, hard to pack; low strength; medium to low shear strength and medium to low permeability of compacted soil material in substratum.	High water table; rapid permeability in organic layer; unstable when wet; frequent flooding.	Very high available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.
Plano: PnA, PnB	Moderate permeability.	Medium to low shear strength; medium to low permeability of compacted soil material; stones in substratum.	Natural drainage is adequate.	Very high available water capacity; moderate permeability.	Slope is 0 to 6 percent.
Poy: Pr	Rapid permeability in substratum; high water table.	Medium to low shear strength; medium to low permeability of compacted subsoil material; high permeability of compacted soil material in substratum; piping hazard; high shrink-swell potential.	Slow permeability in subsoil, rapid permeability in substratum; high water table; ponding.	Moderate available water capacity; slow permeability; poorly drained.	Slope is 0 to 2 percent; poorly drained; clayey subsoil.
Poygan: Py	Slow permeability; high water table.	Medium to low shear strength; low permeability of compacted soil material; high shrink-swell potential.	Slow permeability; high water table; ponding.	Moderate available water capacity; slow permeability; poorly drained; slow intake rate.	Slope is 0 to 2 percent; poorly drained; clayey subsoil.
Richford: RaB, RaC	Moderately rapid permeability; seepage.	Medium shear strength; low to high permeability of compacted soil material; piping hazard; stones.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard; slope; stones.	Slope is 1 to 15 percent; sandy; difficult to vegetate; soil blowing hazard; complex slopes; stones.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Ripon: ReB	Moderate permeability; fractured dolomite bedrock at a depth of 20	Medium to low shear strength; medium to low permeability of	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; dolomite	Slope is 1 to 6 percent; dolomite bedrock at a depth of 20 to 40 inches;

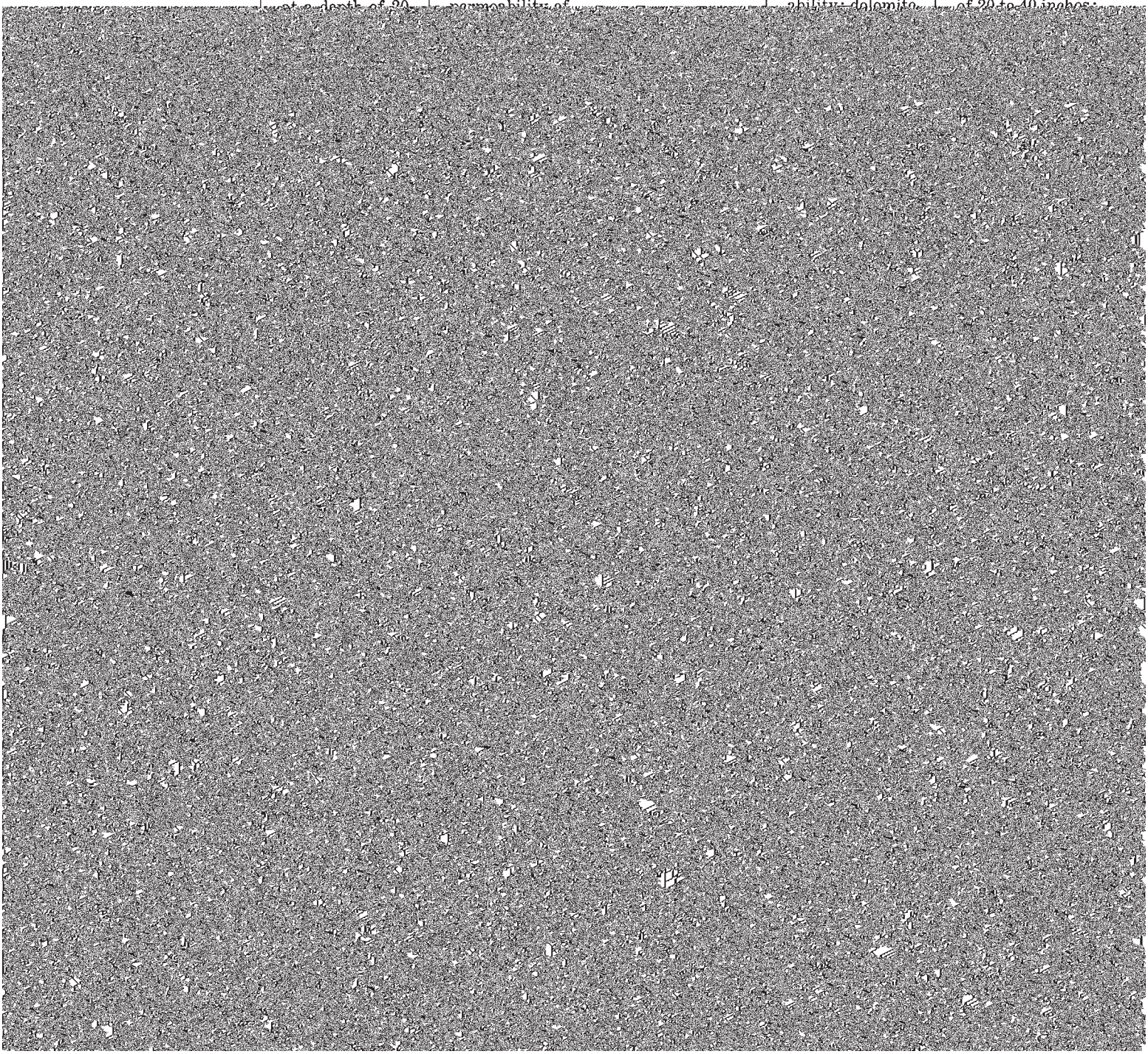
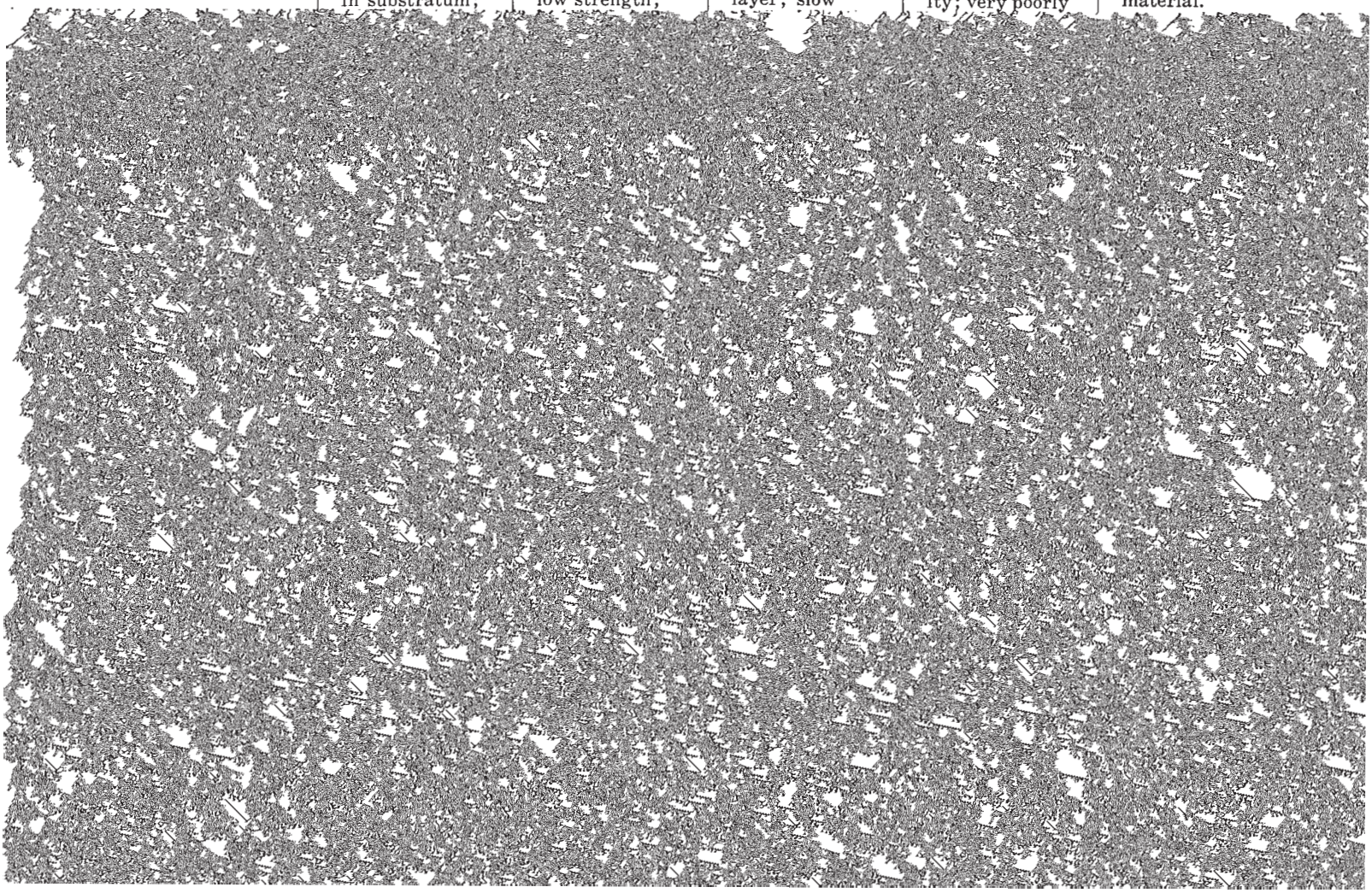


TABLE 11.—*Soil features affecting water management*—Continued

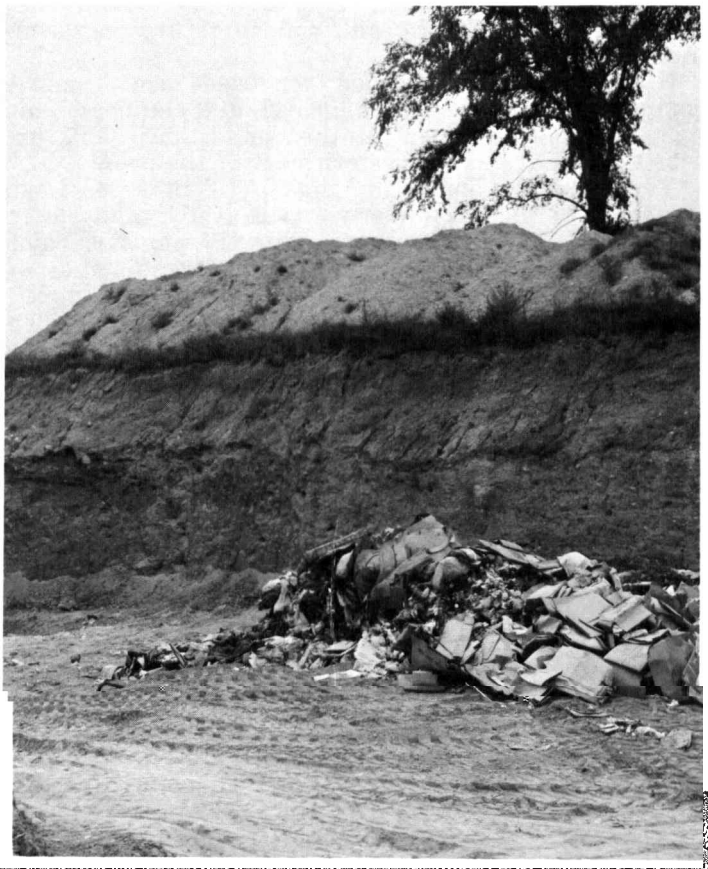
Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Tustin: TuB	Rapid permeability in upper part of subsoil; slow permeability in lower part of subsoil and in substratum.	Medium to low shear strength; medium to low permeability of compacted soil material; high shrink-swell potential in lower part of subsoil; piping in sand.	Natural drainage is adequate.	Low available water capacity; rapid permeability in upper part of subsoil, slow permeability in lower part of subsoil; soil blowing hazard.	Slope is 1 to 6 percent; sandy; difficult to vegetate; soil blowing hazard; clayey material at a depth of 20 to 40 inches.
Urne: UrB, UrC2, UrD2	Moderately rapid permeability; weakly cemented sandstone at a depth of 20 to 40 inches.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; thin layer over weakly cemented sandstone bedrock.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard.	Slope is 2 to 30 percent; sandy; soil blowing hazard; cemented sandstone at a depth of 20 to 40 inches.
Willette: We	Rapid permeability in organic layer; slow permeability in substratum;	Organic layer compressible, hard to pack; low strength;	High water table; rapid permeability in organic layer; slow	Very high available water capacity; rapid permeability; very poorly	Slope is 0 to 2 percent; very poorly drained organic material.



transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 10, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period (fig. 16). Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 10 apply only to a depth of about 6 feet, and ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet; nevertheless, every site should be investigated before it is selected for a landfill.



Roads and streets, as rated in table 10, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 5 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material or plant response when fertilizer is added to the soil; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments also affect suitability. Also considered in the ratings is damage that can result at the site from which topsoil is taken.

Pond reservoir areas, as described in table 11, hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable.

Drainage for crops and pasture is affected by the per-

slope; susceptibility to flooding by streams, water erosion, or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures has outlets for runoff and is not difficult to vegetate.

Soil test data

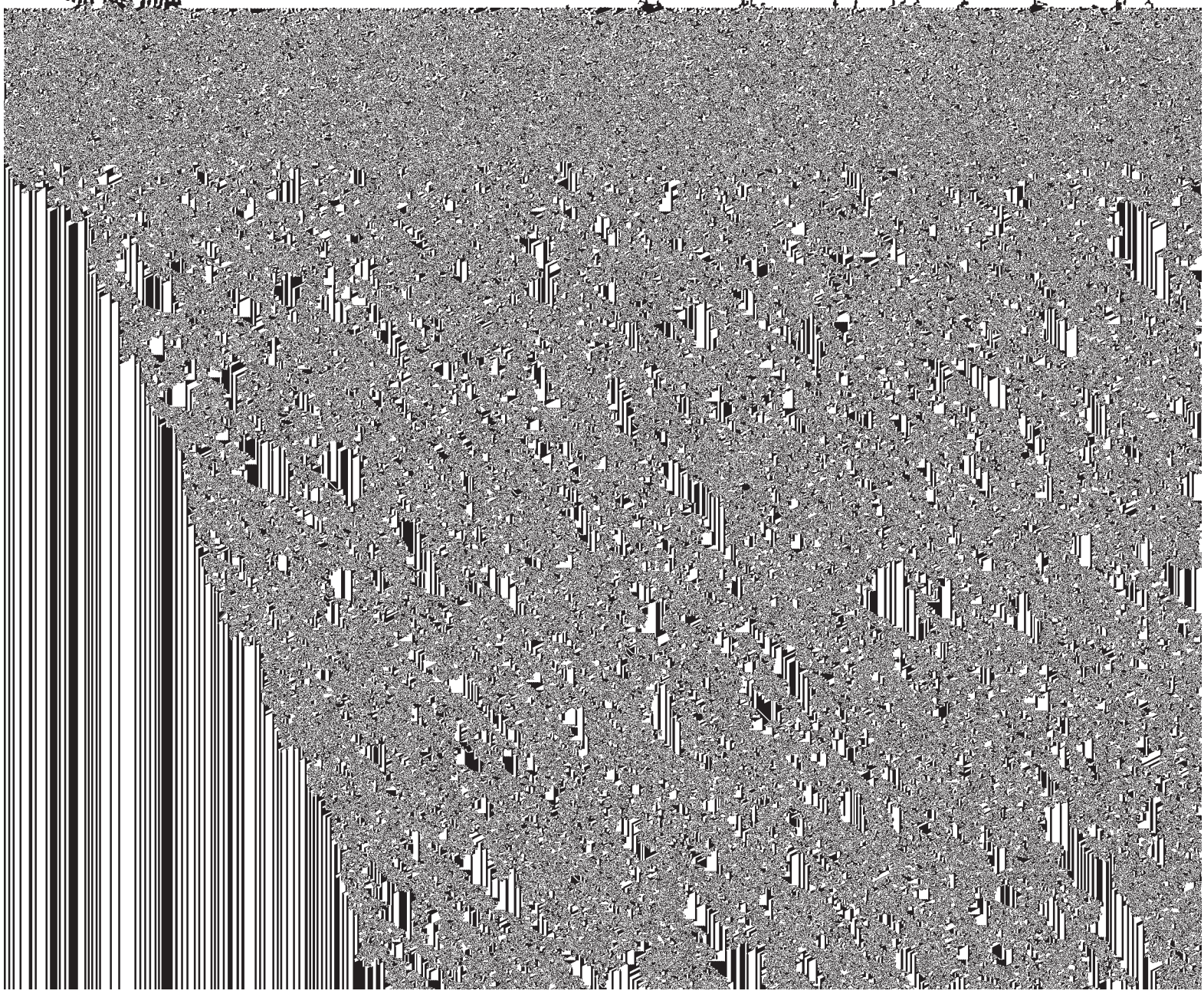
profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It largely determines the chemical and mineralogical composition of the soil.

Most of the soils in Green Lake County are derived from parent materials that are a direct or indirect result of the glacier. Even the soils that formed in material weathered over bedrock show some glacial



in the southeastern part of the county. The lower subsoil of LeRoy, Lomira, Markesan, and Mendota soils formed in this kind of till.

Windblown silt mantles the high plain in the southeastern part of the county. Some of the best soils formed in windblown silt and the underlying glacial till. Dodge, Lomira, Mendota, Plano, and St. Charles soils commonly formed in these silts.

Windblown sands from the central sand plain of Wisconsin are common in the western parts of the county. This sand mantle extends into some parts of eastern Green Lake County, where it generally mantles an earlier soil that formed in glacial till. The sand is mostly fine and medium size sand, which indicates the distance that it has been blown from its source. The finer the particle size, the more readily it can be moved by the wind. This gradation in sand size is even noticeable going from west to east in Green Lake County. It is especially noticeable on the western margin of the high plain. The sand particles were evidently too heavy to reach the highest part of the plain, but approach silt size along its margin. Gotham and Oakville soils commonly formed in thick deposits of windblown sands. Okee soils formed in windblown sands mantling glacial till.

Lacustrine deposits consist mostly of stratified silt and fine sand, although there are some clayey deposits in the northern part of the county. These are sedimentary deposits that were laid down in the still

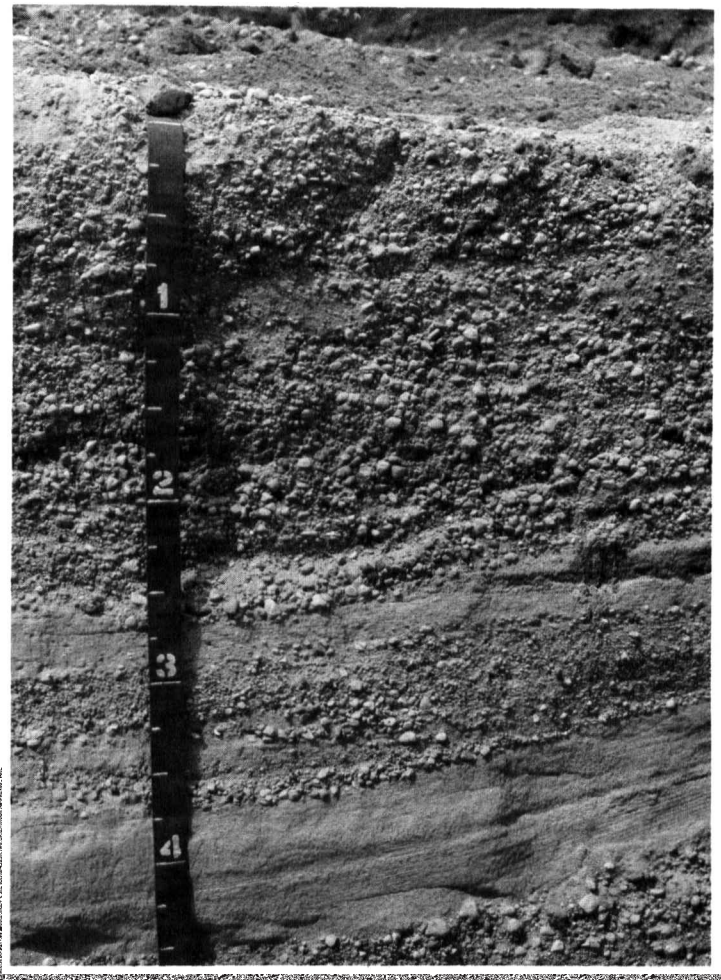


TABLE 12.—*Engineering*

[Tests performed by Wisconsin Department

Soil name and location	Parent material	Depth	Moisture-density [1]		Mechanical analysis [2]		
			Maximum dry density	Optimum moisture	Percentage less than 3 inches passing sieve—		
					1 in	¾ in	⅜ in
		In	*Lb per cu ft*	*Pct*			
Boyer loamy fine sand: NE¼SE¼SE¼ sec. 25, T. 16 N., R. 11 E. (Modal profile)	Loamy drift and stratified sand and gravel.	9–19				100	96
		31–60			87	81	73
Briggsville silt loam: NW¼NE¼NE¼ sec. 2, T. 17 N., R. 13 E. (Modal profile)	Stratified clayey and loamy lacustrine material.	13–30					
		34–60	97.0	23.8			
Colwood silt loam: NE¼SW¼NW¼ sec. 15, T. 16 N., R. 13 E. (Modal profile)	Stratified loamy and sandy lacustrine material.	15–22					
		28–38					
Dodge silt loam: SW¼SW¼SE¼ sec. 6, T. 15 N., R. 13 E. (Modal profile)	Loess and gravelly sandy loam glacial till.	27–32					
		33–60			89	87	80
Friesland loam: SW¼SW¼NW¼ sec. 19, T. 15 N., R. 13 E. (Modal profile)	Loamy drift, silt loam aeolian material and gravelly sandy loam glacial till.	13–21					
		38–45					
		74–78			97	93	87
Kidder fine sandy loam: NW¼NE¼SE¼ sec. 3, T. 14 N., R.	Loamy drift and gravelly sandy loam glacial till	11–26					
		34–60	135.2	7.9	95	94	91

test data

of Transportation, Division of Highways]

Mechanical analysis [2]—Continued							Liquid limit [3]	Plasticity index [4]	Classification	
Percentage less than 3 inches passing sieve—Continued				Percentage smaller than—					AASHTO [5]	Unified
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
							Pct			
92	86	67	23	22	13	11	19.2	3.3	A–2–4(0)	SM
69	64	49	2	2	1	1	----------	[6] NP	A–1–b(0)	SP
----------	----------	100	97	97	77	49	61.0	35.6	A–7–6(20)	CH
----------	100	99	94	94	77	51	58.1	32.1	A–7–6(20)	CH
----------	100	98	68	64	34	28	36.8	20.2	A–6–(11)	CL
----------	100	98	83	81	34	18	25.6	8.7	A–4–(8)	CL
----------	100	95	57	52	32	27	33.8	17.8	A–6(7)	CL
75	69	62	33	28	9	6	----------	NP	A–2–4(0)	SM
----------	100	99	65	57	17	13	18.8	2.4	A–4–(6)	ML
----------	----------	100	97	92	32	24	37.9	17.5	A–6–(11)	CL
82	76	66	25	20	5	3	----------	NP	A–2–4(0)	SM
----------	100	94	39	38	23	19	22.9	8.7	A–4(1)	SC
89	88	79	35	32	11	8	----------	NP	A–2–4(0)	SM
90	89	80	31	25	11	9	----------	NP	A–2–4(0)	SM
78	76	69	21	19	8	6	----------	NP	A–2–4(0)	SM
----------	100	92	43	41	18	15	21.4	7.1	A–4(2)	SC–SM
86	85	77	22	19	8	6	----------	NP	A–2–4(0)	SM
93	91	82	12	10	5	3	----------	NP	A–2–4(0)	SP–SM

TABLE 12.—*Engineering*

Soil name and location	Parent material	Depth	Moisture-density [1]		Mechanical analysis [2]		
			Maximum dry density	Optimum moisture	Percentage less than 3 inches passing sieve—		
					1 in	¾ in	⅜ in
		In	*Lb per cu ft*	*Pct*			
Sisson loam: SW¼SW¼SW¼ sec. 23, T. 16 N., R. 13 E. (Modal profile)	Stratified loamy and sandy lacustrine material.	12–34					
		39–60	122.5	12.1			
Zittau silty clay loam: NE¼NE¼SW¼ sec. 3, T. 17 N., R. 13 E. (Modal profile)	Loamy and clayey deposits underlain by loamy fine sand and sand.	13–24					
		30–42					

[1] Based on AASHTO Designation T 99–57, Method A (*1*).

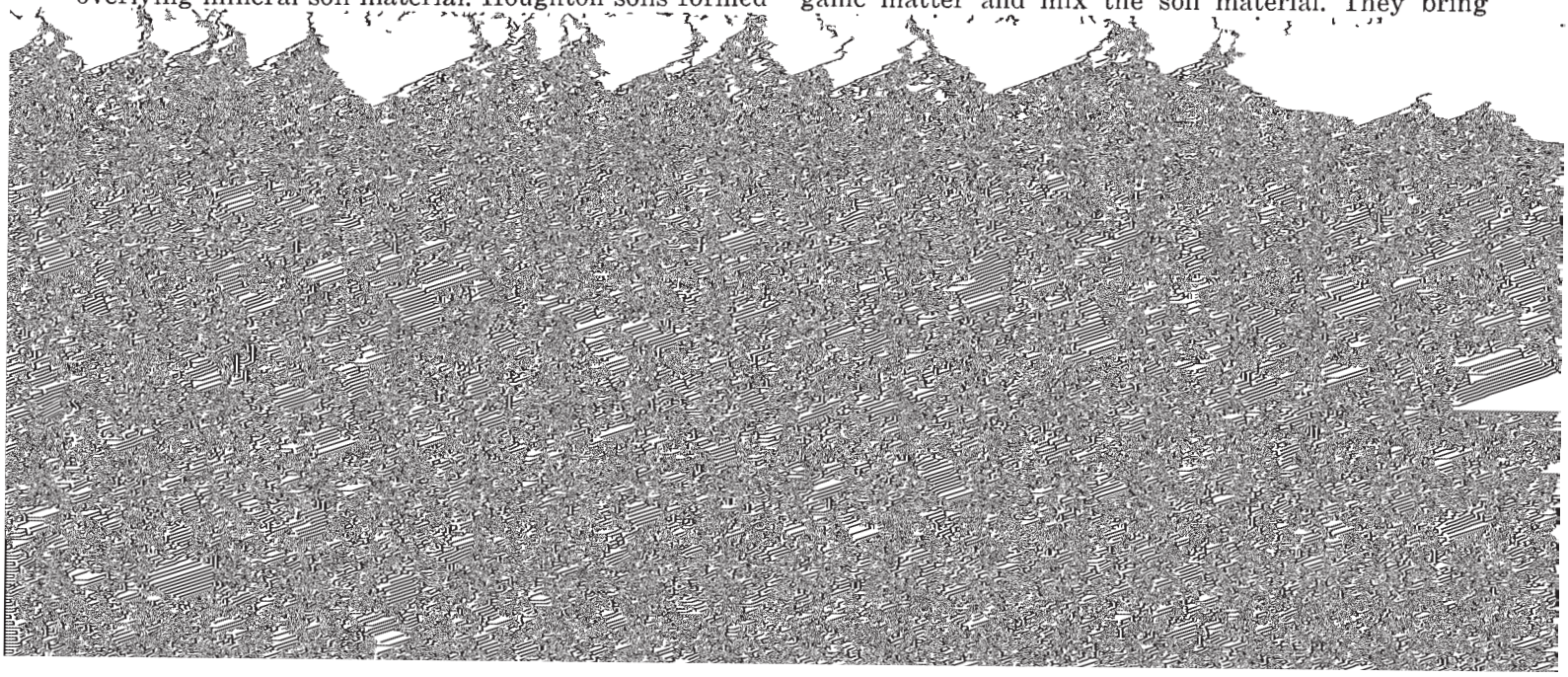
[2] Mechanical analysis according to the AASHTO Designation T 88–57 (*1*). Results by this procedure may differ somewhat from the results obtained by the Soil Survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by hydrometer method, and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain-size fractions. The mechanical analyses data in this table are not suitable for use in naming textural classes of soil.

rock is deeply mantled by glacial deposits in most places. Isolated escarpments of sandstone, generally on the lower positions below dolomite escarpments, are scattered throughout the county. Gotham, sandstone substratum, and Urne soils were derived from or are underlain by sandstone. Most of the acreage of these soils is in the southwestern part of the county.

Organic matter is the parent material for numerous soils in the county. It mainly consists of sedges, reeds, and grasses in various stages of decomposition. Adrian and Palms soils are representative of soils that formed in 16 to 50 inches of organic material overlying mineral soil material. Houghton soils formed too small to have any great effect on differences in the soils. The area is within a climatic zone, however, where both prairie vegetation and woodland vegetation are competing for dominance in the soil-plant regime. Mendota and Plano soils are representative of soils that formed under grassland vegetation. They have a thick, dark-colored surface layer. Dodge, Kidder, and Lapeer soils formed under woodland vegetation and lack the thick, dark-colored surface layer.

Plant and animal life

Plants and animals in and on the soil provide organic matter and mix the soil material. They bring



test data—Continued

Mechanical analysis [2]—Continued							Liquid limit [3]	Plasticity index [4]	Classification	
Percentage less than 3 inches passing sieve—Continued				Percentage smaller than—						
No. 4	No. 10	No. 40	No. 200						AASHTO [5]	Unified

The relationship of relief to soil formation is shown by the general pattern of thin, steep soils and of progressively better developed, deeper soils that have gentler slopes. The deeper soils contain more clay in the subsoil than the thin, immature soils. Boyer and Rodman soils show the influence of relief on soil development. These soils formed in the same kind of parent material, but the generally more sloping Rodman soils lack the clay accumulation and well-defined structure in the B horizon that is characteristic of the deeper, more gently sloping Boyer soils.

Drainage characteristics are generally reflected in the color, degree, and kind of mottling or gleying in the soil profile. Well-drained Dodge, Griswold, and Kidder soils are mottle-free throughout the solum. Friesland, Grellton, and Plano soils are well drained and moderately well drained. Many of the nearly level and gently sloping soils of these series have mottles in the lower part of the B horizon.

Joy, Kibbie, and Manawa soils are representative of the somewhat poorly drained soils in the county. They are mottled throughout the B and C horizons. Barry, Colwood, Marshan, and Ossian soils are representative of the poorly drained soils in the county. They are generally mottled in the A horizon and gleyed in the B and C horizons.

Time

Time has had some effect on differences among the soils of the survey area. Soils of the alluvial plains, for example, do not have distinct horizons, because the soil material has not been in place long enough for the soil-forming processes to take full effect. Well-drained soils that formed in glacial till and in windblown silts, on the other hand, have well-defined horizons as the result of processes that have been active for thousands of years. In some soils, such as the Joy, Ossian, and Plano soils along natural drainageways, new material is added to the surface from time to time and covers an older soil

the soil and produced a greater volume of organic residue and acids.

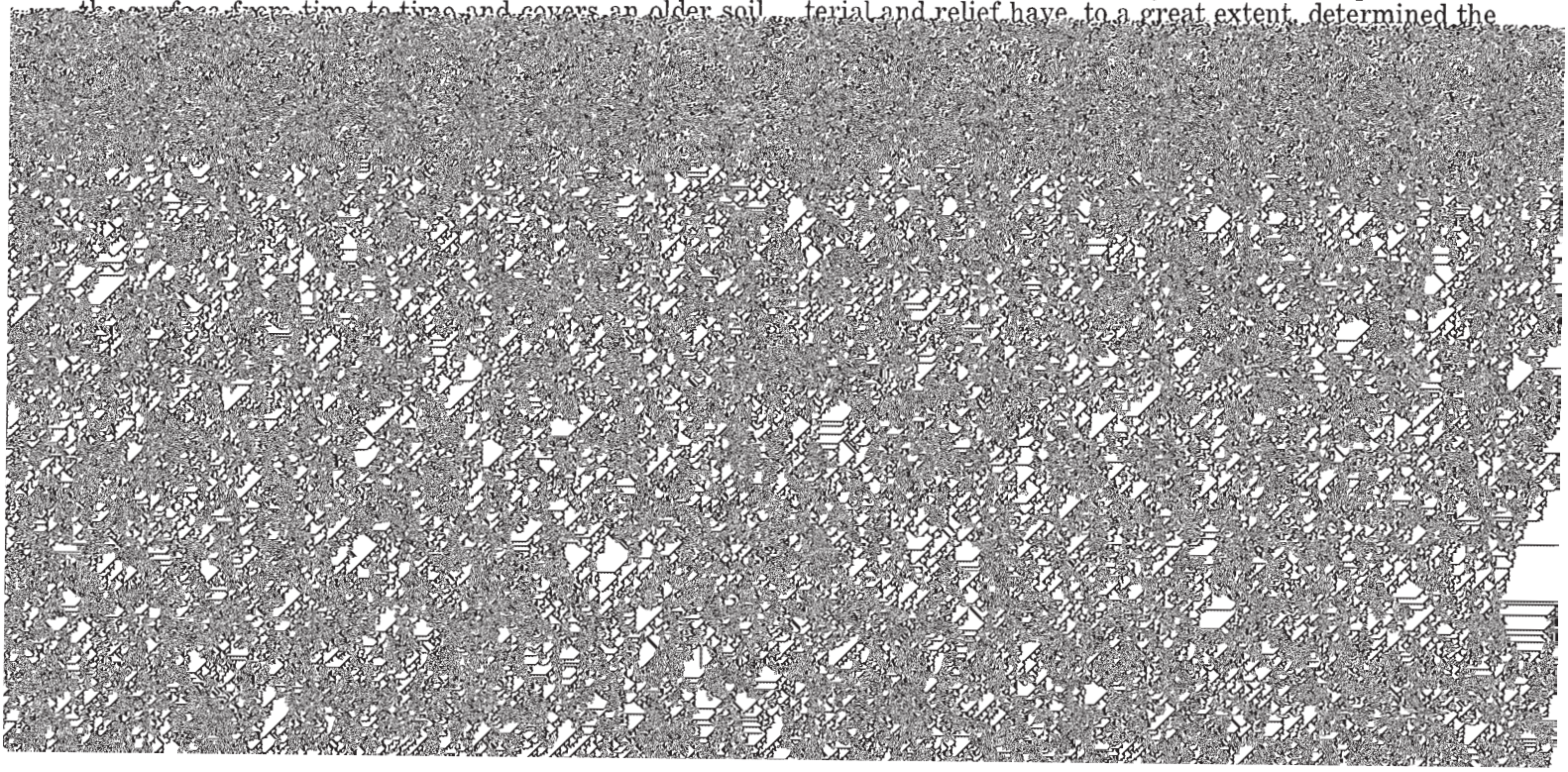
Free lime in the soil material gradually dissolved and was moved downward by percolating waters into the lower part of the soil. As water continued to move downward through the soil, suspended particles of clay also were translocated. As a result, the Plano soil has more clay in the lower part of the silty layer and the upper part of the glacial till than in other parts. While clay was being moved downward in the soil, organic matter in various stages of decomposition was accumulating on or near the surface. The decomposed organic matter gave the surface layer a darker color than it originally had.

While these changes were occurring in the silty part of the soil, the loamy lower part was forming in till of mixed minerology that contained a significant amount of dolomite fragments. Chemical weathering of the dolomite and other weatherable minerals gradually changed this layer to a mixture of gravel and heavy sandy loam. Oxidized iron, which occurs as impurities in the dolomite, gives this layer a darker color than the underlying unweathered till.

As a result of these soil-forming processes, the Plano soils now have a surface layer of silt loam and a subsoil that is silty clay loam in the upper part and is dark-brown heavy sandy loam in the lower part. These soils are underlain at a depth of about 58 inches by unweathered, moderately alkaline till that has changed little since it was deposited by the glacier.

Processes that took place in the formation of Plano soils were *gains* of organic matter in the surface layer, *loss* of clay from the upper part of the soil and subsequent *transfer* to the lower part of the profile, and *transformation* of iron compounds in the lower part of the subsoil.

All these processes are active in all soils of the survey area. In Green Lake County, the kinds of parent material and relief have, to a great extent, determined the



readers interested in developments of the current literature should consult the detailed literature available

are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family

TABLE 13.—*Classification of soil series*

Series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic	Terric Medisaprists	Histosols.
Barry	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Brems	Mixed, mesic	Aquic Udipsamments	Entisols.
Briggsville	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Colwood	Fine-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Dodge	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Friesland	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Gotham	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Granby	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby, clayey subsoil variant	Sandy over clayey, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby, loamy subsoil variant	Sandy over loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Grellton	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Griswold	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Joy	Fine-silty, mixed, mesic	Aquic Hapludolls	Mollisols.
Kibbie	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Kidder	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Knowles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Lapeer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
LeRoy	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Lomira	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Manawa	Fine, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Marcellon[1]	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.

Figure 18.—**Sinkhole in an area of Plano soils. Ground water may become polluted if manure or pesticides are spread near sinkholes. Sinkholes often lead to underground crevices or caverns in the underlying dolomite.**

slopes. In the areas underlain by dolomite, many deep valleys have been formed by geological erosion of the relatively soft sandstone.

Big Green Lake, the deepest lake in Wisconsin, has a sandstone bottom. It was once connected to Lake Puckaway, now a shallow lake with nearly 300 feet of recent sediments over sandstone, and formed a major drainageway for melt water during glacial times. A glacial dam of water-sorted sand and gravel now separates the two lakes.

Much of the loose sand which mantles the western parts of the county probably came from sandstone weathered and disintegrated by the glacier. This sand was later moved by glacial melt water and by the wind. The sand moved by glacial melt water left thick deposits of valley fill. Sand was blown onto the uplands and now mantles the older soils that formed in other materials, mostly glacial till. The mantle of windblown sand is generally thickest in the western part of the county and is thin or lacking in the eastern part. Some sand dunes extend into the eastern part of the county, which indicates that the wind direction was generally from the west or northwest. In some areas of Manchester Township the sand mantle is in strips that have a general north-south orientation, which indicates that the wind direction was northerly during the time of sand deposition. Where the sand mantle is thin over the older soils, or is in strips, there is a complex pattern of contrasting surface textures.

The sandstone in Green Lake County is dominantly silica sand, but has glauconitic sand strata in the upper part. Urne soils formed in glauconitic sand high in potassium. Potassium is a plant nutrient which sandy soils usually lack. There are two large sandstone quarries in Green Lake County where the sandstone is blasted, ground, and dried for commercial use (fig. 19).

The four outcroppings of igneous bedrock are in Berlin, Mackford, Marquette, and Seneca Townships. All of the outcrops were once quarried, but the Berlin quarry is the only one still operating. Much of the igneous bedrock has been used for gravestones and some for building material.

The dredged channel in Lake Puckaway was probably made to transport the granite quarried on the south side of the lake during the post-Civil War era. An old road crossing a large marsh from the igneous outcrop in Seneca Township is reported to have been built to transport quarried rock. This road now appears

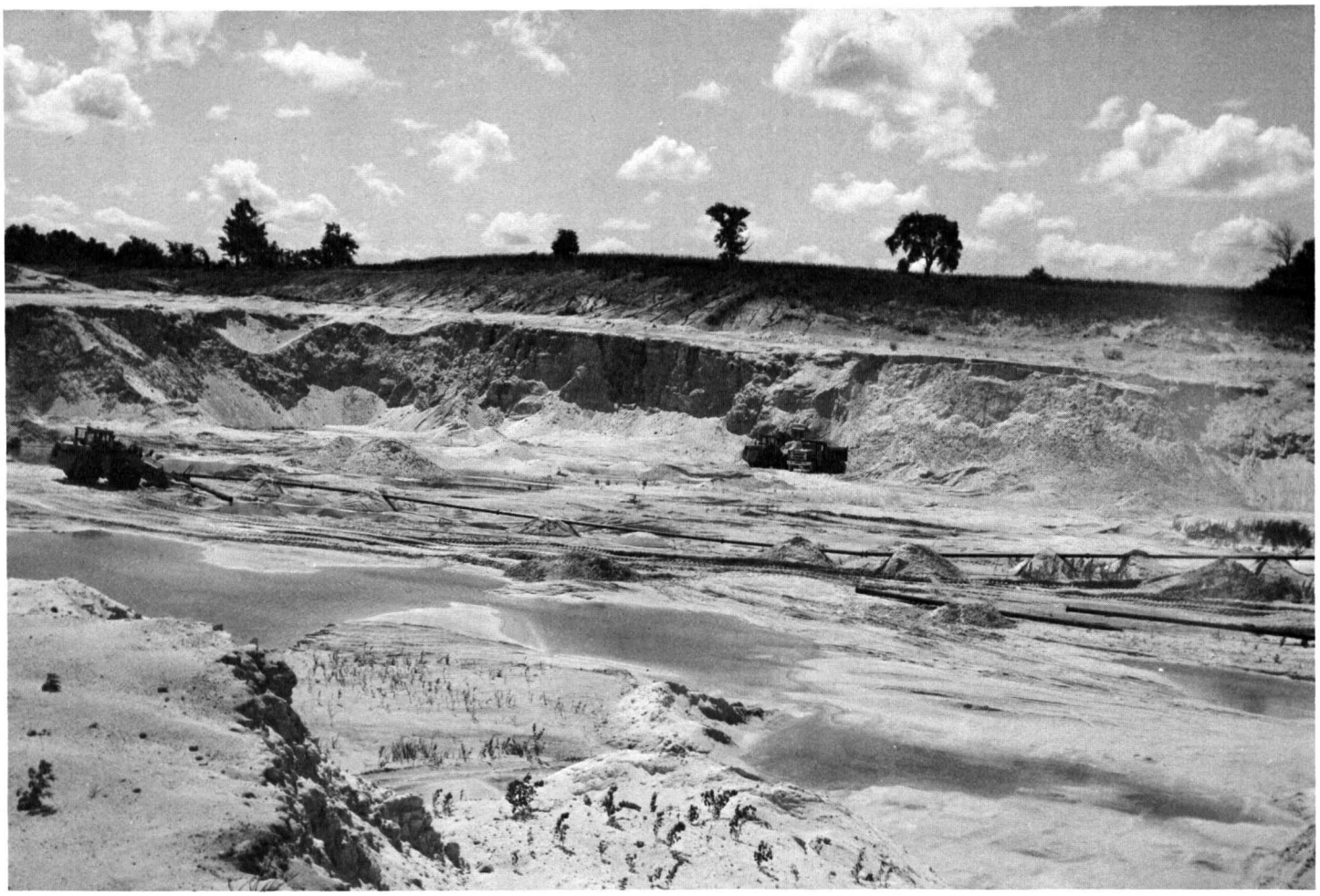


Figure 19.—**Sandstone quarry in Green Lake Township. This high-quality silica sand is used in glass and for foundry sand.**

as a faint line on the aerial photograph. Originally the road was paved with logs to support the heavy loads of granite on the soft organic soil (fig. 20).

Most of the southern and eastern parts of the county are underlain by gravelly sandy loam glacial till which contains a few pits. The material is generally used for road construction and fill. The till is a relatively good filtering media and has only slight limitations for many soil uses. Kidder, Lapeer, Mecan, and Rotamer soils formed in glacial till in the more rolling parts of the county. These soils generally contain a significant amount of coarse fragments. Most of the fragments are partly rounded igneous rock, and some of the larger boulders are more than 4 feet in diameter. Because many areas of glacial till soil are wet or are not cleared of trees or have boulders on the surface, they are not cleared for cultivation.

Stone fences and barn foundations made from field stones are commonly near soils that formed in glacial till. Many stone fences are 6 to 10 feet wide and several feet high. The stones were taken from nearby fields over a period of many years. Some additional stones are exposed each year as a result of frost heaving, erosion, and soil blowing.

Many of the landforms, especially drumlins, in the more rolling parts of the county underlain by glacial till have long, uniform slopes. The drumlins have a general east-west orientation and are as much as 1 mile long. These landforms are suited to erosion control practices such as stripcropping, terraces, and diversions.

Glacial outwash is stratified sand and gravel which was deposited by glacial melt water. These materials are desirable for road building and for making concrete. Several areas of these deposits are scattered throughout Green Lake County, the most extensive along the Grand River near Manchester and at the west end of Green Lake. These deposits are valley-fill materials between hills of glacial till. Scattered, thin remnants of outwash mantle the lower slopes of many hills which border the larger glacial drainageways.

There are large pits in the outwash deposits near Manchester and at the west end of Green Lake. The extensive deposits between Green Lake and Lake Puckaway block what was a major drainageway during glacial times. Much of this area has hills and depressions which are the result of large blocks of ice melting in the outwash deposits. The badly pitted areas are generally not suited to extensive cultivation because slopes are steep and irregular and the soil is commonly thin over sand and gravel. Many of these areas were never cleared

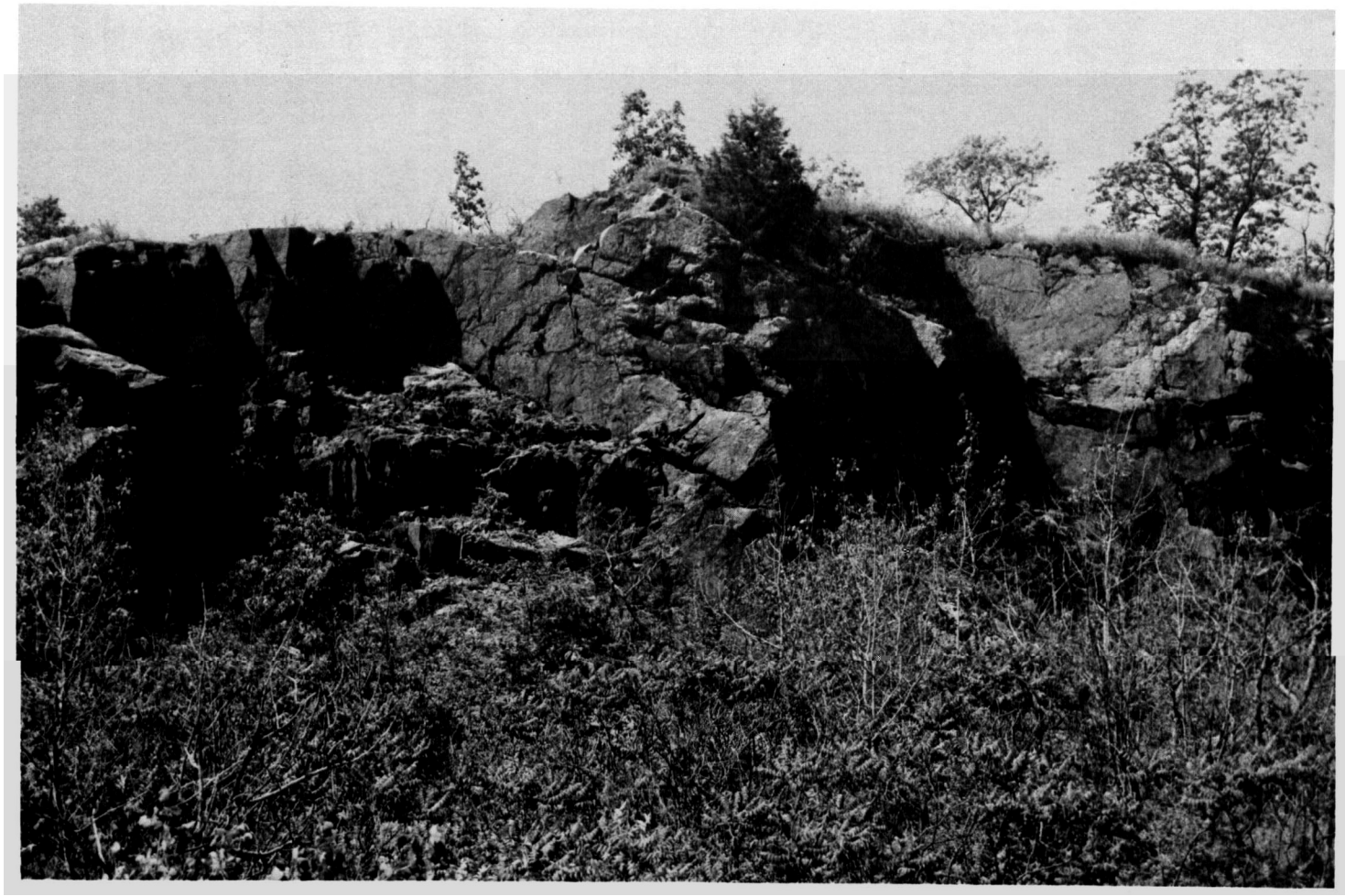


Figure 20.—**An outcrop of igneous rock, sometimes called "black granite." In the past it has been used for cemetery headstones.**

of trees. The outwash deposits in Green Lake County are mostly sandy and contain only small amounts of gravel. These deposits have less value for most uses than the more gravelly deposits.

Climate [5]

The climate of Green Lake County is continental, typical of the center of a continent in the middle lati-

annual temperatures tends to be less at higher elevations and greater at lower elevations and in large expanses of marshland. Minimum temperatures are lowered by the drainage and accumulation of cold air in these places.

The temperature and precipitation for Green Lake County are given in table 14. Temperatures of 90° or higher have occurred on an average of 14 days a year, but the number of days has varied from 32 in

TABLE 14.—*Temperature and precipitation data*

[Data from records at Dalton Weather Station]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
						Less	More		

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from records at Dalton Weather Station]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 14	April 24	May 4	May 16	May 29
2 years in 10 later than	April 8	April 18	April 28	May 10	May 24
5 years in 10 later than	March 28	April 7	April 17	April 30	May 13
Fall:					
1 year in 10 earlier than	October 24	October 17	October 3	September 18	September 10
2 years in 10 earlier than	October 30	October 22	October 9	September 25	September 15
5 years in 10 earlier than	November 10	November 2	October 20	October 5	September 26

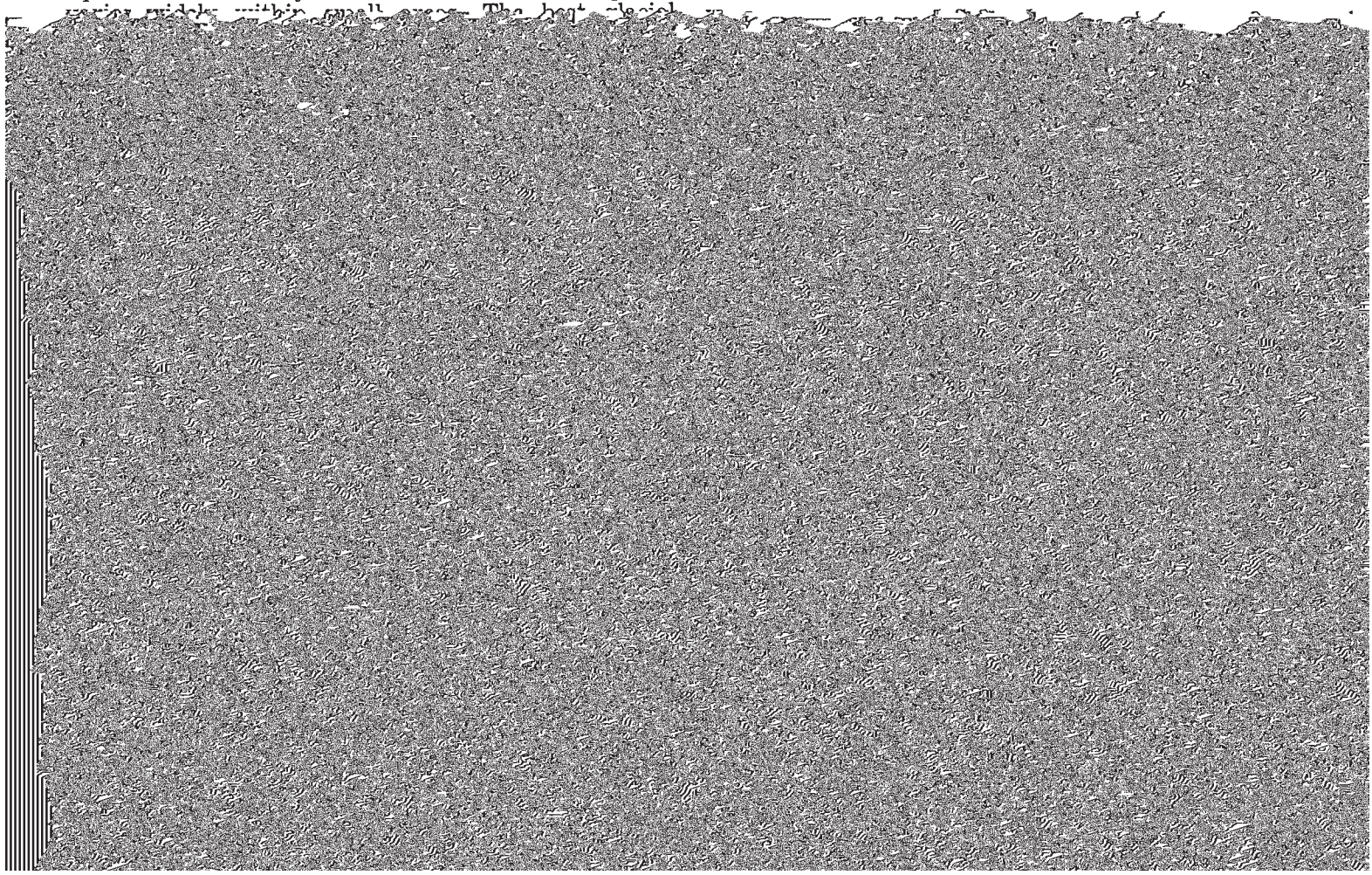
in the northwestern part of the county, well yields are 10 to 100 gallons a minute. The crystalline rock generally does not yield water to wells.

The Platteville-Galena aquifer generally yields less than 50 gallons per minute to wells, but it is important for domestic and farm wells. This unit tends to prevent vertical movement of water, causing artesian pressures in the underlying sandstone aquifer.

Glacial deposits which overlie the bedrock are also aquifers. Availability of water from these deposits varies widely within small areas. The best glacial

The southeastern part of the county is a high plain or plateau that covers nearly 30 percent of the county. This area was a grassland prairie when the first settlers arrived.

Approximately 19.6 percent of the land area was originally wetlands that were too wet for most trees and grasses. These wetlands supported a growth of marsh grasses, shrubs, and trees such as bur oak, soft maple, elm, and tamarack.



are businesses that service and sell machinery and other farm supplies in Berlin, Markesan, Montello, Princeton, and Ripon. There are also several livestock markets in the Green Lake County area which buy and sell cattle, calves, hogs, and feeder pigs.

Trends in Soil Use

The number of farms in the county is decreasing, and the average size per farm is increasing. In 1964, there were 961 farms in Green Lake County with an average size of 182.8 acres. In 1969, there were 877 farms with an average size of 193.1 acres (*24*).

Many areas of sandy soil and soils that have a low available water capacity have been retired from farming and planted to pine trees. An increasing amount of land is being used for nonagricultural uses, such as rural nonfarm homes, summer cottages, camping, and recreational areas. The county's attractive lakes, streams, and wetlands and its accessibility to residents of the Fox River Valley, southeastern Wisconsin, and northern Illinois make it a favorable rural retreat for urban residents. Areas near the many lakes and streams are becoming increasingly important as homesites and recreational areas. Wooded tracts throughout the county are also in demand for these uses (*7*).

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(21) United States Department of Agriculture. 1951. Soil Surv. Manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Suppl. issued May 1962)
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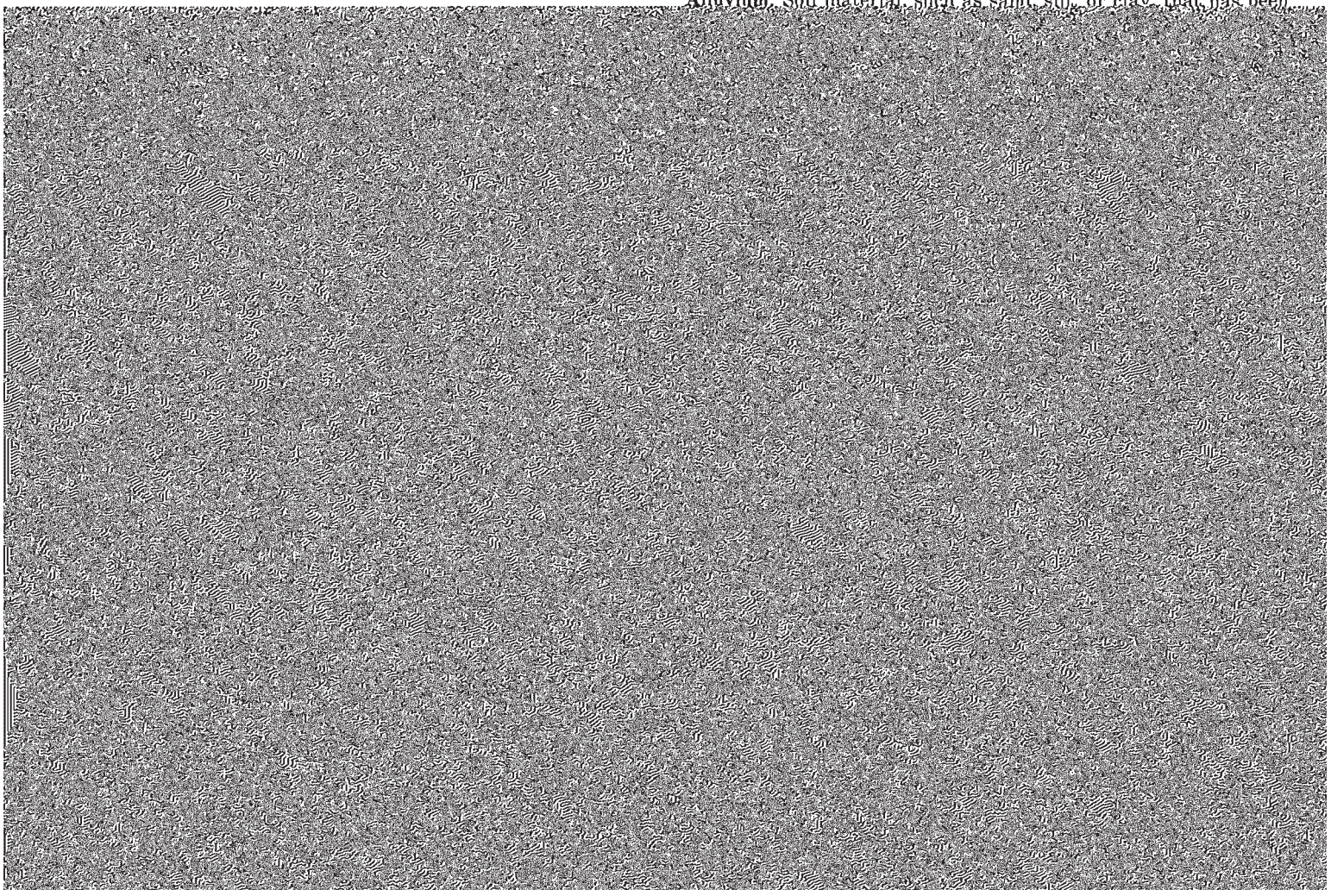
(24) Wisconsin Department of Business Development. 1970. Economic profile of Green Lake County, Wisconsin. 6 pp.
(25) Wisconsin Department of Natural Resources. 1968. Wisconsin forest resource statistics, Lake Winnebago survey report.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been



Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer within or directly above the parent material, periodically receive enough water to form mottles, or are somewhat poorly drained soils that have had their moisture relations improved by artificial drainage.

Somewhat poorly drained soils commonly have a slowly permeable layer within the soil profile, periodically receive enough water to form mottles, or are poorly drained soils that have had their moisture relations improved by artificial drainage.

Poorly drained soils commonly have a high water table, periodically receive enough water to form mottles, or are very poorly drained soils that have had their moisture relations improved by artificial drainage.

Very poorly drained soils commonly have a high water table and are frequently ponded.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Forage. Vegetation, other than separated grain and sugar crops, that can be harvested for feed. Both wild and cultivated plants are included.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the discussion of soil profiles, the following horizons are recognized:

A horizon.—The upper horizon of mineral soil. It is commonly referred to as the surface soil and is the horizon of maximum biological activity and of eluviation.

B horizon.—The horizon below the A horizon. It is commonly referred to as the subsoil and is the horizon of illuviation.

C horizon.—The horizon below the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

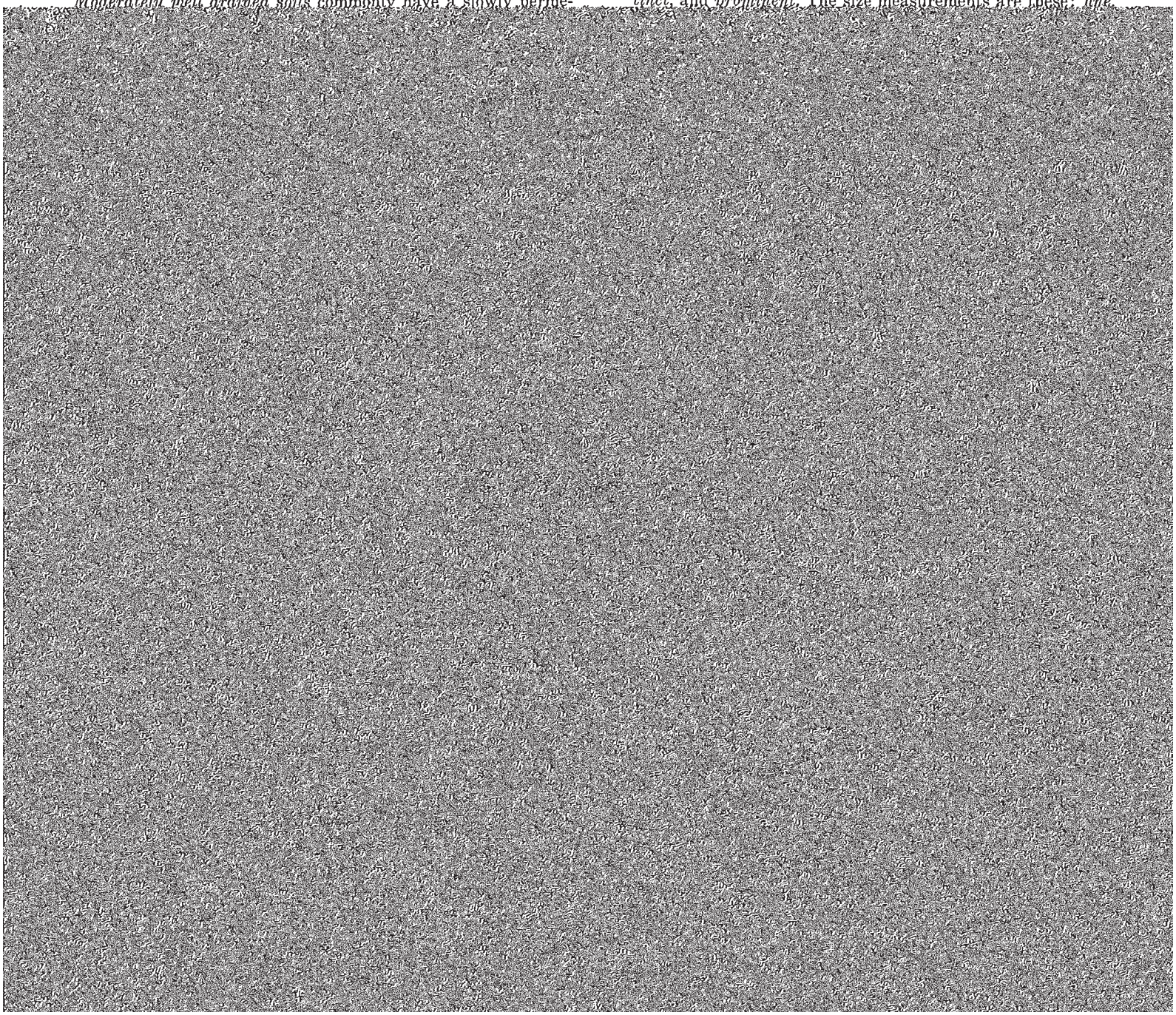
R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,*



consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil slope. The difference in elevation in feet between two points 100 feet apart, given in percent. The slope symbol, percent of slope, and slope class of the soils in Green Lake County are as follows: A, 0 to 2 percent, nearly level; B, 2 to 6 percent (0 to 6 percent for sandy soils), gently sloping; C, 6 to 12 percent, sloping; D, 12 to 20 percent, moderately steep; and E, 20 to 30 percent, steep. In some of the moderately steep and steep soils, the slope groups are slightly different than listed here. Soils that have no slope symbol are considered nearly level.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are similar. The plant

(angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

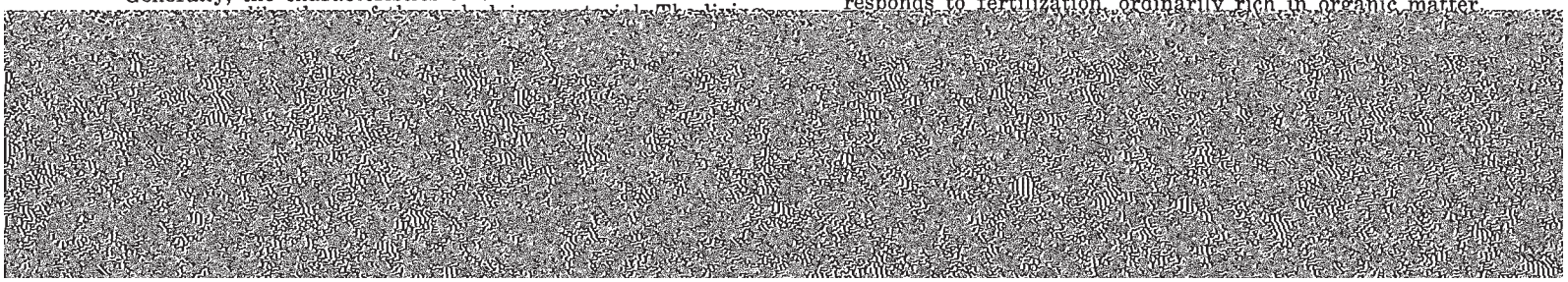
Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit, a woodland suitability group or any other group, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
Ad	Adrian muck	9	IVw-7	66	3w3	4	8	8
An	Alluvial land, wet	11	Vw-14	66	4w2	3	7	7
Bb	Barry loam	11	IIw-1	62	4w2	3	7	7
BpB	Boyer loamy fine sand, 1 to 6 percent slopes	12	IIIs-4	65	3o1	2	1	2
BpC2	Boyer loamy fine sand, 6 to 12 percent slopes, eroded	13	IIIe-7	64	3o1	2	1	2
BpD	Boyer loamy fine sand, 12 to 25 percent slopes	13	IVe-7	65	3r1	2	1	2
BrB	Brems loamy fine sand, 0 to 6 percent slopes	14	IVs-3	66	3s1	2	3	2
BsA	Briggsville silt loam, 0 to 2 percent slopes	14	IIe-6	62	2c1	1	2	3
BsB	Briggsville silt loam, 2 to 6 percent slopes	15	IIe-6	62	2c1	1	2	3
Co	Colwood silt loam	15	IIw-1	62	1w1	3	7	7
DdB	Dodge silt loam, 2 to 6 percent slopes	16	IIe-1	61	2o1	1	1	1
DdC2	Dodge silt loam, 6 to 12 percent slopes, eroded	16	IIIe-1	63	2o1	1	1	1
Ed	Edwards muck	17	IVw-7	66	3w3	4	8	8
FoA	Friesland loam, 0 to 2 percent slopes	18	I-4	61	---	1	5	1
FoB	Friesland loam, 2 to 6 percent slopes	18	IIe-1	61	---	1	5	1
GaB	Gotham loamy fine sand, 1 to 6 percent slopes	18	IVs-3	66	3s1	2	3	2
GaC	Gotham loamy fine sand, 6 to 12 percent slopes	19	IVs-3	66	3s1	2	3	2
GbC	Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	19	IVs-3	66	3s1	2	3	4
GbD	Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes	19	VIe-7	68	3s3	2	3	4
Gf	Granby loamy fine sand	20	IVw-5	66	3w1	3	7	7
GhA	Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes	21	IIIw-6	64	3w1	3	7	7
GkA	Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes	21	IIIw-6	64	3w1	3	7	7
GnA	Grellton fine sandy loam, 0 to 2 percent slopes	22	I-4	61	1o1	1	1	1
GnB	Grellton fine sandy loam, 2 to 6 percent slopes	22	IIe-1	61	1o1	1	1	1
GnC2	Grellton fine sandy loam, 6 to 12 percent slopes, eroded	22	IIIe-1	63	1o1	1	1	1
GnD2	Grellton fine sandy loam, 12 to 20 percent slopes, eroded	23	IVe-1	65	1r1	1	1	1
GrA	Griswold silt loam, 0 to 2 percent slopes	23	I-4	61	---	1	5	1
GrB	Griswold silt loam, 2 to 6 percent slopes	24	IIe-1	61	---	1	5	1
GrC2	Griswold silt loam, 6 to 12 percent slopes, eroded	24	IIIe-1	63	---	1	5	1
Ho	Houghton muck	24	IIIw-9	64	3w3	4	8	8
JoA	Joy silt loam, 0 to 3 percent slopes	25	IIw-2	62	4o1	3	6	6
KbA	Kibbie loam, 0 to 3 percent slopes	26	IIw-2	62	1o2	3	6	6
KdA	Kidder fine sandy loam, 0 to 2 percent slopes	27	I-4	61	2o1	1	1	1
KdB	Kidder fine sandy loam, 2 to 6 percent slopes	27	IIe-1	61	2o1	1	1	1
KdC2	Kidder fine sandy loam, 6 to 12 percent slopes, eroded	27	IIIe-1	63	2o1	1	1	1
KdD2	Kidder fine sandy loam, 12 to 20 percent slopes, eroded	27	IVe-1	65	2r1	1	1	1
KeA	Kidder loam, 0 to 2 percent slopes	28	I-4	61	2o1	1	1	1
KeB	Kidder loam, 2 to 6 percent slopes	28	IIe-1	61	2o1	1	1	1
KeC2	Kidder loam, 6 to 12 percent slopes, eroded	28	IIIe-1	63	2o1	1	1	1
KeD2	Kidder loam, 12 to 20 percent slopes, eroded	28	IVe-1	65	2r1	1	1	1
KeE	Kidder loam, 20 to 30 percent slopes	28	VIe-1	67	2r1	1	1	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
KwA	Knowles silt loam, 0 to 2 percent slopes	29	IIe-2	62	2o1	1	1	4
KwB	Knowles silt loam, 2 to 6 percent slopes	29	IIe-2	62	2o1	1	1	4
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded	30	IIIe-2	63	2o1	1	1	4
KwD2	Knowles silt loam, 12 to 20 percent slopes, eroded	30	IVe-2	65	2r1	1	1	4
LaB	Lapeer loamy fine sand, 2 to 6 percent slopes	30	IIIe-4	63	3o1	1	1	2
LaC2	Lapeer loamy fine sand, 6 to 12 percent slopes, eroded	31	IVe-4	65	3o1	1	1	2
LaD2	Lapeer loamy fine sand, 12 to 25 percent slopes, eroded	31	VIe-4	67	3r1	1	1	2
Lb	Lapeer fine sandy loam, 0 to 2 percent slopes	31	IIIs-4	65	3o1	1	1	2
LrC2	LeRoy silt loam, 6 to 12 percent slopes, eroded	32	IIIe-1	63	2o1	1	1	1
LrD2	LeRoy silt loam, 12 to 20 percent slopes, eroded	32	IVe-1	65	2r1	1	1	1
LvB	Lomira silt loam, 2 to 6 percent slopes	33	IIe-1	61	2o1	1	1	1
LvC2	Lomira silt loam, 6 to 12 percent slopes, eroded	33	IIIe-1	63	2o1	1	1	1
LvD2	Lomira silt loam, 12 to 20 percent slopes, eroded	33	IVe-1	65	2r1	1	1	1
MaA	Manawa silt loam, 0 to 3 percent slopes	34	IIw-2	62	2c2	3	6	6
McA	Marcellon loam, 0 to 3 percent slopes	34	IIw-2	62	2o1	3	6	6
MdB2	Markesan silt loam, 2 to 6 percent slopes, eroded	35	IIe-1	61	---	1	5	1
MdC2	Markesan silt loam, 6 to 12 percent slopes, eroded	36	IIIe-1	63	---	1	5	1
MdD2	Markesan silt loam, 12 to 20 percent slopes, eroded	36	IVe-1	65	---	1	5	1
Mf	Marsh	36	VIIIw-15	68	6w1	---	7	8
Mh	Marshan silt loam	37	IIw-5	62	4w2	3	7	7
MnB	Mecan loamy fine sand, 2 to 6 percent slopes	38	IIIe-4	63	3o1	1	1	2
MnC2	Mecan loamy fine sand, 6 to 12 percent slopes, eroded	38	IVe-4	65	3o1	1	1	2
MsA	Mendota silt loam, 0 to 2 percent slopes	39	I-4	61	---	1	5	1
MsB	Mendota silt loam, 2 to 6 percent slopes	39	IIe-1	61	---	1	5	1
MsC2	Mendota silt loam, 6 to 12 percent slopes, eroded	39	IIIe-1	63	---	1	5	1
OaB	Oakville fine sand, 1 to 6 percent slopes	40	IVs-3	66	3s1	2	3	2
OaC	Oakville fine sand, 6 to 12 percent slopes	40	VIs-3	68	3s1	2	3	2
OaD	Oakville fine sand, 12 to 35 percent slopes	41	VIIs-3	68	3s3	2	3	2
OkB	Okee loamy fine sand, 1 to 6 percent slopes	42	IIIs-4	65	2s1	1	1	2
OkC	Okee loamy fine sand, 6 to 15 percent slopes	42	IIIe-7	64	2s1	1	1	2
OmB	Oshtemo loamy fine sand, 1 to 6 percent slopes	43	IIIs-4	65	3o1	2	1	2
OmC2	Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	43	IIIe-7	64	3o1	2	1	2
Os	Ossian silt loam	44	IIw-1	62	3w2	3	7	7
Pa	Palms muck	44	IIw-8	63	3w3	4	8	8
PnA	Plano silt loam, 0 to 2 percent slopes	45	I-4	61	---	1	5	1
PnB	Plano silt loam, 2 to 6 percent slopes	45	IIe-1	61	---	1	5	1
Pr	Poy silty clay loam	46	IIw-5	62	2w1	3	7	7
Py	Poygan silty clay loam	47	IIw-1	62	2w1	3	7	7
PrB	Richford loamy sand, 1 to 6 percent slopes	47	IIIs-4	65	3o1	2	3	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
RkE	Rock land and Ritchy soil, 6 to 45 percent slopes	50	VIIIs-10	69	6s1	---	10	5
Ro	Rock outcrop	51	VIIIs-10	69	6s1	---	10	5
RsD	Rodman gravelly sandy loam, 6 to 20 percent slopes	51	VIs-5	68	4f2	2	4	2
RsE	Rodman gravelly sandy loam, 20 to 35 percent slopes	51	VIIs-5	68	4f2	2	4	2
RtB2	Rotamer sandy loam, 2 to 6 percent slopes, eroded	52	IIe-1	61	---	1	5	1
RtC2	Rotamer sandy loam, 6 to 12 percent slopes, eroded	53	IIIe-1	63	---	1	5	1
RtD2	Rotamer sandy loam, 12 to 20 percent slopes, eroded	53	IVe-1	65	---	1	5	1
RtE	Rotamer sandy loam, 20 to 30 percent slopes	53	VIe-1	67	---	1	5	1
ScA	St. Charles silt loam, 0 to 2 percent slopes	54	I-4	61	1o1	1	1	1
ScB	St. Charles silt loam, 2 to 6 percent slopes	54	IIe-1	61	1o1	1	1	1
ScC2	St. Charles silt loam, 6 to 12 percent slopes, eroded	54	IIIe-1	63	1o1	1	1	1
SnB	Sisson loam, 2 to 6 percent slopes	55	IIe-1	61	1o1	1	1	1
SnC2	Sisson loam, 6 to 12 percent slopes, eroded	55	IIIe-1	63	1o1	1	1	1
SnD2	Sisson loam, 12 to 20 percent slopes, eroded	55	IVe-1	65	1r1	1	1	1
TuB	Tustin loamy fine sand, 1 to 6 percent slopes	56	IIIe-4	63	3o1	2	2	3
UrB	Urne loamy fine sand, 2 to 6 percent slopes	57	IIIs-4	65	3o1	2	3	4
UrC2	Urne loamy fine sand, 6 to 12 percent slopes, eroded	57	IIIe-7	64	3o1	2	3	4
UrD2	Urne loamy fine sand, 12 to 30 percent slopes, eroded	57	IVe-7	65	3r1	2	3	4
We	Willette muck	58	IIIw-8	64	3w3	4	8	8
ZtA	Zittau silty clay loam, 0 to 3 percent slopes	59	IIw-5	62	3c2	3	6	6

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